A Social-Cognitive Model of Monitoring and its Relationship to Behaviour in a Naturalistic Observation: Developmental and Individual Differences

by

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Abstract

This study assessed the development of monitoring skills in 24 younger (M = 4 years 8 months) and 24 older (M = 7 years 4 months) children. A *Monitoring Process Model* (MPM) was developed and tested in order to ascertain at which component process of the MPM age differences would emerge. The MPM had four components: (1) **assessment;** (2) **evaluation;** (3) **planning;** and (4) **behavioural control**. The MPM was assessed directly using a referential communication task in which the children were asked to make a series of five Lego buildings (a baseline condition and one building for each MPM component). Children listened to instructions from one experimenter while a second experimenter in the room (a confederate) interjected varying levels of verbal feedback in order to assist the children and control the component of the MPM. This design allowed us to determine at which "stage" of processing children would most likely have difficulty monitoring themselves in this social-cognitive task.

Developmental differences were observed for the evaluation, planning and behavioural control components suggesting that older children were able to be more successful with the more explicit metacomponents. Interestingly, however, there was no age difference in terms of Lego task success in the baseline condition suggesting that without the intervention of the confederate younger children monitored the task about as well as older children. This pattern of results indicates that the younger children were disrupted by the feedback rather than helped. On the other hand, the older children were able to incorporate the feedback offered by the confederate into a plan of action.

Another aim of this study was to assess similar processing components to those

investigated by the MPM Lego task in a more naturalistic observation. Together the use of the Lego Task (a social cognitive task) and the naturalistic social interaction allowed for the appraisal of cross-domain continuities and discontinuities in monitoring behaviours.

In this vein, analyses were undertaken in order to ascertain whether or not successful performance in the MPM Lego Task would predict cross-domain competence in the more naturalistic social interchange. Indeed, success in the two latter components of the MPM (**planning** and **behavioural control**) was related to overall competence in the naturalistic task. However, this cross-domain prediction was not evident for all levels of the naturalistic interchange suggesting that the nature of the feedback a child receives is an important determinant of response competency.

Individual difference measures reflecting the children's general cognitive capacity (Working Memory and Digit Span) and verbal ability (vocabulary) were also taken in an effort to account for more variance in the prediction of task success. However, these individual difference measures did not serve to enhance the prediction of task performance in either the Lego Task or the naturalistic task.

Similarly, parental responses to questionnaires pertaining to their child's temperament and social experience also failed to increase prediction of task performance. On-line measures of the children's engagement, positive affect and anxiety also failed to predict competence ratings.

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Dedication

I dedicate this thesis to my husband, best friend and mentor Tim who shares my love of learning and has been the major driving force behind my educational pursuits.

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Introduction

As its name implies, research in the area of social cognition focuses on a number of overlapping issues in the cognitive and social domains of psychology. Social-cognitive development is concerned with issues such as how children reason about their social world, the developmental changes in this type of reasoning, and understanding the relationship between cognitive development and social behaviour (see Shantz, 1983 for a review).

While some researchers have proposed that social cognition mediates behaviour (e.g., Shantz, 1983), there has often been a failure to find strong correlations between measures of social cognition and social behaviours in children (Mischel & Mischel, 1983; Shantz, 1975). Moreover, the relationships that are found tend to be represented by low to moderate correlations. Indeed, there are many reasons why children's cognitions may not be translated into behaviours. However, little research has been done to investigate the specific links between social cognitions and social behaviours within a developmental framework.

One reason for the observed thought-behaviour discrepancy may be the fundamental difference between ability and performance as capacity for behaviour precedes mastery (McDevitt & Ford, 1987). Young children, for example, may be capable of performing certain social-cognitive tasks in testing situations in which researchers may tap optimal levels of performance. However, given an actual social interchange, children's cognitive systems may become overloaded due to the inherent complexity of social interactions progressing in real time, leading to a reduction in performance level.

Indeed, it has been suggested that the working memory capacity of the child limits his/her ability to perform complex behaviours (Case, 1978, 1985). Further, the ability to keep cognitions "in mind" while deciding on behavioural choices is a complex strategy which may be too difficult for young children to perform well. Thus in "real-life" settings where the allocated attentional resources are increased compared to laboratory tasks, young children may lack the attentional resources necessary for competent cognitive evaluations of the situation (Markman, 1981). This may render young children not only less able to monitor their thought processes but also their behavioural expressions in an unfolding social situation compared to older children.

Another possibility is that children's thoughts and behaviours differ because young children have less sophisticated strategies and techniques that they can implement compared to older children. Consistent with Piaget's theory of cognitive development, Case (1978) observed that throughout the preschool years children pass through a series of substages in which the strategies they employ become increasingly complex and powerful. In other words, the content of the preschool (preoperational) child's strategies is qualitatively different from those employed by older (concrete operational) children.

Overview of Rationale for study

The purpose of this study was to assess the development of monitoring skills in children. To this end, a four component *Monitoring Process Model* (MPM) was developed and tested in order to ascertain at which component process of the MPM age differences would emerge. The four components of the MPM were (1) **assessment;** (2) **evaluation;** (3) **planning;** and (4) **behavioural control**. The MPM was assessed directly using a social-cognitive Lego Task that was developed for this study. This task was modelled after a comprehension monitoring paradigm first described by Flavell, Speer, Green, and August (1981). One of the primary goals of this study was to use the MPM in order to determine at which "stage" of processing children would most likely have difficulty monitoring themselves in a social-cognitive task.

Another aim of this study was to assess similar processing components to those investigated by the MPM Lego task in a more naturalistic observation. With this in mind, the Birthday Task was developed. Together the use of the Lego Task (which was a social cognitive task) and the Birthday Task (a more naturalistic social interaction which will be described later) allowed for the appraisal of cross-domain continuities and discontinuities in monitoring behaviours.

These two tasks also allowed for the investigation of the possibility of a thought-behaviour discrepancy with respect to monitoring skills in children. It was expected that even younger children who could achieve success in the MPM Lego Task would be less competent in the naturalistic Birthday Task compared to older children due to the increased processing demands of an unfolding social interaction progressing in real time.

The structure of the remainder of the introduction is as follows: first, I will give a brief description of monitoring and describe the proposed *Monitoring Process Model*. Then I will present a survey of relevant literature on monitoring and self-monitoring in both the cognitive and social divisions of psychology in order to show the strengths and weaknesses of prior conceptions of monitoring and how the current model improves on these conceptions. A description of individual differences that may impact monitoring as well as the utility of assessing monitoring using communication tasks will be discussed. Finally, the purpose of this study and the four hypotheses investigated will be stated.

Monitoring and the Proposed Model

Monitoring is a construct that has been broadly used in psychology. In cognitive psychology, for example, monitoring refers to particular mental skills including the ability to evaluate one's deviation from some desired or goal state and the ability to adjust one's behaviour based on feedback in order to come closer to a goal (e.g., Miller, Galanter, & Pribram, 1960). In social psychology, the term used for people directing their actions toward a goal (involving corrective action etc.) has often been referred to as self-regulation (e.g., Carver & Scheier, 1981; Fiske & Taylor, 1991; Markus & Wurf, 1987). In social psychology monitoring is viewed as a self-regulatory behaviour. Specifically, it is most often used in the sense of self-monitoring, in terms of controlling or regulating one's expressive behaviour in a social setting in order to create an impression (Snyder 1974, 1979).

There are several common defining features of these varied uses of the monitoring construct. Two salient features are that (i) monitoring involves control and/or regulation;

and (ii) that it is viewed as a process.

For the purposes of this study, the term "monitoring" will refer to four intimately connected phases which incorporate both common aspects of the monitoring construct. The first step in the proposed ***Monitoring Process Model*** **(MPM)** is the internal, psychological assessment of an event or situation: it will be referred to as the **assessment** phase. This phase is similar to a problem detection phase and is a necessary precursor to the other stages of the MPM.

The second step of the MPM is **evaluation** of the problem detected in step one in terms of its importance with respect to a situational goal. Similar to control systems models, the goal is the reference value against which the child monitors and is outside of the feedback loop (see Carver & Scheier, 1982 for a complete explanation). The goal may also be subordinate to another superordinate goal. For example, the child's situational goal may be to persuade another child to play a game but the superordinate goal may be to make a new friend.

The third step of the monitoring process will be referred to as the **planning** phase. In this stage, on the basis of the situational goal, an individual derives a plan or strategy to alleviate any discrepancy between the current state and the goal state, or perhaps recognizes that no behavioural change is warranted.

The fourth step of the MPM is comprised of the concurrent appropriate control, regulation, and/or modulation of behaviours (to be referred to as **behavioural control**). In other words, given that the individual has diagnosed some situational problem, and devised a plan for dealing with it, he or she then implements the plan by changing his or her behaviour and monitors the results.

The proposed MPM represents a feedback loop as re-evaluations and re-modifications may take place in service of a situational goal. The following is an example of the monitoring process which illustrates how the MPM can be applied to a typical social situation.

Suppose that a child's situational goal is to verbally communicate some information to another person. The child would be monitoring the situation while speaking and, based on verbal (e.g., "I do not understand") or nonverbal (e.g., a puzzled look) feedback, might **assess** that there is a problem. At this point, he or she **evaluates** the nature of the problem and determines that the other person does not understand the intended message. The child also considers whether or not this is important in terms of the situational goal and whether or not his or her own behaviour should be changed. He or she then **plans** what might be done to assist communicative effectiveness. Factors that may be considered at this point include the relative importance of the goal of successful communication, and the ease with which a different communication strategy can be devised.

Finally, the actual **behavioural control** or modulation takes place. Such changes may involve asking the listener if he/she understood what was said, speaking slower, or providing an example. At this point there may be a return to step one **(assessment)** if needed. It is presumed that these four steps of the monitoring process may be assessed independently although they may occur very close in time, particularly in an on-line social interchange.

The MPM allows for failures in monitoring to occur at any of the four component phases. For example, the speaker may not notice a puzzled look on the listener's face and so may be unaware that there is a problem (failure to assess). Or the speaker may detect some problem without being able to appreciate the nature of it in light of the situational goal (failure to evaluate). Step three failures arise when an individual is able to assess and evaluate communicative problems effectively but is unable to devise a strategy or plan of what might be done in order to assist in communicating effectively. Lastly, there are those instances in which a speaker is successful with all three preceding steps but fails to, or perhaps chooses not to, implement a plan of action to modify his/her behaviour (step four, or behavioural control, failure).

In order to delineate how the proposed MPM construct differs from previous conceptions of monitoring and also how it is similar to them, I will briefly review research literature pertaining to monitoring within the cognitive and social domains of psychology. Recurrent themes will be the exploration of the development of monitoring or self-monitoring behaviours in children and consideration of how individual differences in monitoring skills might arise.

Monitoring in the Cognitive Domain

At any given time, adaptive systems assess, or monitor, the difference between the current state of the organism and some expected or desired state. This strategy has been referred to as means-ends analysis (Newell & Simon, 1972). Due to this on-line monitoring, feedback is readily available to the system so that actions can be performed in order to reduce any deviation between the current state and the desired or goal state. In this model the problem solver focuses on one goal at a time in a system that may be comprised of several subgoals. These subgoals are set by the problem solver in order to achieve a broader, or superordinate, goal (Carver & Scheier, 1982). In this manner behaviours can be considered in terms of a hierarchical structure.

Any single behaviour can be seen as being comprised of a number of smaller, or component, processes giving rise to an overall behaviour. Component behaviours have been referred to as molecular and are considered to represent a lower level in the hierarchy than more global behaviours (see Benjafield, 1992, pp. 23-24). These behaviours are thought to represent a higher level in the hierarchy.

Higher level behaviours are described in terms of their goals (e.g., going to Europe for a vacation) whereas lower level behaviours are considered to be components of these larger processes. For example, there are many different ways in which the goal of going to Europe can be achieved. One might travel by boat, or plane, with friends or alone. As well, these molecular units can be broken into smaller units such as initially selecting a travel agent, getting travel brochures to decide upon the destination, budgeting the money, packing the clothes, etc. Thus, by using the terminology of molar and molecular units, behaviours can be described at several different levels reflecting their hierarchical organization (see Benjafield, 1992 p. 24).

Miller and his colleagues (1960) referred to the processes that regulate behaviour from the molar to the molecular, or from the top down, as plans. Plans represent a set of instructions which are required to carry out actions. Plans can also be represented as a structure that consists of monitoring units known as Testing Operating Testing Exiting (or TOTE) mechanisms (Miller, Galanter, & Pribram, 1960).

TOTEs are a feedback loop of actions which are engaged in by intelligent beings in order to reduce deviations between current states and goal states and to modify behaviour. Incongruities are reduced via controlled behaviours as well as the ongoing assessment of whether or not the incongruities are being reduced. For example, an individual might be looking for a particular book in the library by call number. He/she compares (tests) each call number he/she sees to the one he/she is looking for. As long as these two numbers do not match he/she continues to look for the book (operate). Once he/she has obtained a match (test), he/she then has the book he/she was looking for and exits the procedure. In this way TOTE procedures can be viewed as basic building blocks of more complex behaviours because simpler TOTEs can be nested within more elaborate TOTEs (Am I in the right aisle? Am I on the right floor?) in the form of hierarchies (Miller et al., 1960).

The proposed MPM is a TOTE mechanism in that it represents an ongoing feedback loop whereby the individual assesses whether or not the situational goal is getting closer, whether or not the goal has been achieved, whether or not further efforts should be abandoned and so forth. In this manner, monitoring is both adaptive and goal-directed; two criteria which make it intelligent behaviour according to Sternberg and Salter (1982).

Sternberg (1984, 1985) has proposed a theory of the processes comprising intelligence. Three essential components were identified: (1) metacomponents; (2) performance components; and (3) knowledge acquisition components. The first component (metacomponent) is of interest with respect to monitoring because metacomponents are "executive processes used in planning, monitoring and decision making in task performance" (Sternberg, 1984, p. 282). Thus monitoring may be related to general intelligence, and thinking about one's own cognitions during the task at hand may be a component of intelligent behaviour.

This type of representational or recursive thinking has been referred to as "metacognition". Metacognition is a term used to describe the enterprise of thinking about cognitive phenomena (e.g., Flavell, 1979; Wellman, 1985). The types of skills encompassed by the term metacognition include planning, self-regulating, self-correcting, as well as self-monitoring (Day, French, & Hall, 1989). Such meta-descriptions allow the monitoring process to be viewed in terms of a hierarchically organized system of problem-solving behaviours. Indeed the proposed MPM is hierarchically organized such that each successive component represents a more complex cognitive or metacognitive skill.

Wellman (1985) described cognitive monitoring as the moment-to-moment understanding of one's own cognitions. He observed that by the second half of the third year of life, children are capable of such metacognitive monitoring. In support of Wellman's (1985) position, there is evidence suggesting that children are aware of when they know something and when they do not (Wellman, 1977; Cultice, Somerville, & Wellman, 1983), when they understand something and when they do not (Markman, 1979), when they are fantasizing, dreaming or imagining and when they are not (Johnson & Raye, 1981). In other words, preschool children (3 years 6 months to 4 years of age) do have some ability to monitor their own internal mental states.

Interestingly, it is at this same point in development when children begin to show increased curiosity about the external, social world as evident in their questions and narratives (Dunn, 1988). Dunn (1988) observed that as children's ideas about others and the social world become clearer, their theories about other people become more detailed. In particular, the roots of children's social understanding is grounded in their understanding of their own and others' emotions (Dunn, 1988). Indeed, young children's understanding of emotions is crucial to their developing social cognition skills because they so frequently use their understanding of the emotional expressions of others during the course of social interaction (Denham, Zoller, & Couchoud, 1994). Thus, social experiences and burgeoning social-emotional understanding assist the development of children's thinking about social situations.

Denham et al. (1994) proposed that it is important to investigate individual differences in emotion understanding because comprehension of one's own emotions help the child to understand and communicate their own feelings better as well as increasing the child's understanding of the emotions of others. Further, these developing theories about others coincide with an ability to conceive of other people as having minds that are separate and distinct from one's own, a position described in the vast literature on children's developing "theories of mind" (see Astington, Harris, & Olson, 1988).

To have a "theory of mind" is to be able to distinguish between the real world and mental representations of the world. This distinction allows for children to, among other things, understand the distinction between talk and action. At this newly achieved level of intellectual development children are able to think of representations as separate objects of thought, or meta-representations (Astington, Harris, & Olson, 1988). It is believed that children begin to develop a theory of mind during the preschool years up to ages five or six. It is also thought that by this age other complex meta-representations of self and others are well established (Flavell, Green, & Flavell, 1995).

Monitoring in Social Psychology:

In social psychology, monitoring refers to the construct first described by Snyder (1974, 1979), who proposed that the ability to manage or control one's expressive presentation is a precursor to effective social and interpersonal functioning. He observed that some people are regulated by their own internal cues and respond accordingly. He referred to such individuals as *Low Self-Monitors* (LSMs). In contrast, Snyder observed that some people attend to, monitor, and control their responses in accord with responses they feel best fit the situation in which they find themselves. These individuals also tend to demonstrate cross-situational variability of behaviour and are referred to as *High Self-Monitors* (HSMs).

Snyder (1974) proposed that HSMs would be concerned with behaviours that were socially appropriate and they would be especially keen to the expression and self-presentation of others. Moreover, he proposed that HSMs would attend to and use situational cues in order to modify their own self-presentation.

To test his hypotheses, Snyder (1974) developed the *Self-Monitoring Scale* in which he described five types of items associated with increased self-monitoring in adults: (1) concern with the social appropriateness of self-presentation; (2) attention to social comparison information; (3) ability to control or modify self-presentation and expressive behaviour; (4) use of this ability in particular situations; and (5) variability of this expressive behaviour and self-presentation across situations. Not surprisingly, HSMs scored higher in all five categories (Snyder, 1974). However, Snyder's logic is circular in that he used items which indicated higher levels of self-monitoring in order to demonstrate that HSMs would receive higher scores on these items.

Consistent with Snyder's findings, Graziano, Leone, Musser, and Lautenschlager (1987) observed that children who were classified as HSMs attended to cues from others and used these cues as guidelines for monitoring (regulating and controlling) their verbal and non-verbal self-presentation. The prototypical question asked by the HSM, according to Graziano and his colleagues, is "what does the situation want me to be and how can I be that person"? In contrast the prototypical question asked by a LSM is: "who am I and how can I be me in this situation"? Therefore, some of the observed differences between HSMs and LSMs may reflect differences in the situational goals set by the individual and not inherent abilities to monitor.

In terms of how monitoring might develop, Snyder (1987) hypothesized that the roots of self-monitoring behaviour may be biologically determined and influenced via socialization during ontogenesis. However, Allen (1986) was the first researcher to investigate developmental aspects of monitoring behaviours and how these behaviours might change across the life span.

Allen (1986) observed that self-monitoring behaviour did not change significantly after the high school years. However, the development of the ability to self-monitor in younger age groups (i.e., through the childhood years and into adolescence) has only recently become an area of interest (e.g., Allen, 1986; Pledger, 1992).

Self-Monitoring in Children

Although this concept of self-monitoring is not in itself developmental in nature, there has been much speculation as to the potential ontogenetic differences in monitoring ability (Graziano et al., 1987). In order to investigate developmental differences, Graziano and his colleagues developed the *Junior Self-Monitoring Scale*. This scale allowed Snyder's construct to be assessed in younger age groups than had previously been tested.

It was proposed that children who were HSMs would seek increased social comparison information when making decisions compared with LSM children. Theoretically the reason for this hypothesis was that in novel situations, when one may be uncertain as to how to behave, other people in the same situation may provide cues as to how to act. As well, individual differences in self-monitoring in adults have been reliably related to the social comparison process (Elliott, 1979; Snyder, 1974). Indeed, children who were HSMs also engaged in more social comparison than their LSM peers (Graziano et al., 1987). Thus there appear to be similarities in monitoring behaviours across age groups, at least in the category of seeking social comparison information.

Self-Monitoring in Adolescents

Until recently, there have been problems (e.g., reduced reliability and reduced internal consistency for both the *Self-Monitoring* and *Junior Self-Monitoring* scales) assessing self-monitoring in individuals who were younger than the college-age subjects used by Snyder. Thus, in an effort to assess the development of self-monitoring behaviours in teenagers, Pledger (1992) developed the *Adolescent Self-Monitoring Scale*. The *Adolescent Self-Monitoring Scale* identified two subscales of self-monitoring in high school students. The two subscales were identical to those identified by Lennox and Wolfe (1984) in their revised version of Snyder's original *Self-Monitoring Scale*. The two factors were (1) the ability to modify self-presentation and (2) sensitivity to the expressive behaviour of others.

Pledger (1992) observed that the overall measure of self-monitoring behaviour (which was a sum of the two factors) increased from early to late adolescence (12 to 18 years of age). In addition, she reported that the subscale of sensitivity to the expressive behaviour of others increased significantly throughout adolescence. The second factor (ability to modify self-presentation) did not change significantly over time.

<u>Limitations of Self-Monitoring using Snyder's conception</u>

One plausible reason for Pledger's finding that the ability to modify self-presentation did not change throughout the adolescent years might have been that her measurements were self-reports. There was little variability in the responses to items thought to tap the second factor and the majority of subjects indicated that they were able to change or modify their behaviours very well. A problem with drawing conclusions from this finding is that, similar to Snyder, it should be presumed that individuals would answer in a socially acceptable manner, particularly HSMs. This problem of self-report remains one of the major difficulties with tests of Snyder's theory. As well, it is important to include behavioural measures in any assessment of self-monitoring behaviour in order to obtain a more objective measure of whether the individual is truly able to modify his/her behaviour in a social situation.

Unfortunately, there are other difficulties with Snyder's assessment of the self-monitoring construct. First, he emphasized the situational variability (an external focus) as opposed to the processes by which monitoring might occur (internal focus) as a reason why behaviour may differ situationally. Moreover, subsequent researchers have found that some of the factors described by Snyder could be combined (Lennox & Wolfe, 1984). For example, Lennox and Wolfe (1984) found that two of Snyder's subscales (cross-situational variability and ability to modify oneself in particular situations) loaded on a single factor.

The proposed MPM will allow for the assessment of monitoring skills which take into account some of the factors that Snyder and other social psychologists have found to be reliably related to self-monitoring. For example, the ability to modify self-presentation will be assessed directly with MPM -4 (**behavioural control**). However, because the MPM emphasizes the *process* of monitoring and will be tested behaviourally, the pitfalls of using a self-report of such monitoring abilities will be avoided. Moreover, because the MPM will be used to determine the development of monitoring skills in children (ages four through eight) the problem of parental reports of their child's abilities will also be avoided.

Despite the forementioned measurement confounds, self-monitoring behaviours have been found to develop in concert with cognitive complexity and communication abilities among adolescents (Pledger, 1992). However, this has not been examined in a sample of younger children, although there has been speculation that individual differences in self-monitoring in childhood may be initially manifested as differential language acquisition patterns (Snyder, 1987). Snyder based this hypothesis on the research of Nelson (1981).

Monitoring and Communication Abilities

Nelson (1981) observed two distinct patterns of language acquisition which she referred to as "referential" and "expressive". Children who were classified as referential acquired a large vocabulary of nouns which they used to convey information about the world. On the other hand, children who were expressive used language as a social vehicle. These distinct patterns of language acquisition are thought to be driven by the social context in which the child lives and may reflect differences in cognitive style (Nelson, 1981).

Additionally, these two patterns of language development can be mapped onto the development of self-monitoring behaviours in that the referential child exhibits characteristics that are parallel to LSMs (Snyder, 1987). Snyder (1987) posited that referential children and LSMs are both "insensitive" to social context. On the other hand, Snyder describes expressive children as dramatists who are more socially (contextually) aware in terms of their language acquisition which would be consistent with what is expected of a HSM. Thus, what Snyder alludes to is that the roots of self-monitoring behaviours may be linked with different patterns of language acquisition which presumably have a biological basis.

These different patterns of language acquisition may also be reflective of different temperamental styles in that children with different temperaments may learn to express themselves differently. However, Snyder has neither investigated the possible links between self-monitoring behaviours and temperament nor has he speculated on a possible association directly.

In this vein, a problem with Snyder's descriptions of the similarities between different patterns of language acquisition and subsequent self-monitoring behaviours is that his social psychological perspective emphasizes the selection of personal and situational goals with little consideration of the actual cognitive processes by which these behaviours might arise. A social-cognitive perspective, in contrast, allows for more process-based descriptions of self-regulatory behaviours such as monitoring while simultaneously considering situational goals (see Fiske & Taylor, pp. 510-552).

As children get older they acquire many cognitive and social skills. One would expect that monitoring abilities (both cognitive and behavioural) also develop. Reasons for this expectation include such things as children's increasing cognitive complexity including working memory capacity (e.g., Siegel & Ryan, 1989), increased sensitivity to the expressive behaviour of others, and increased ability to modify their self-presentation (see Pledger, 1992 for a description of how these variables increase with age). Hence the development of monitoring abilities may relate to more general age-related competencies.

Thus, in concert with testing the proposed MPM, the current study will also test children's working memory capacity for words using a Working Memory Sentence task (Siegel & Ryan, 1989) and digits using Wechler's (1974) Digit Span Task. In addition, a more general measure of receptive vocabulary will also be used (the PPVT-R, Dunn & Dunn, 1981). Other individual difference variables that should theoretically relate to monitoring skill will also be assessed. Social experience in terms of number of friends and related experience would be expected to impact children's abilities to monitor in social situations.

For example, through the course of development the role of the peer group becomes greater than the role of the parents in some domains, one of which is the seeking out of social comparison information (Hartup, 1989). Therefore, the ability to develop self-monitoring skills and control or regulate socially acceptable behaviour would presumably aid in the acquisition of communication skills which are needed within one's peer group. The reverse may also be true. That is, acquisition of communication skills may aid in the development of monitoring skills. This is especially true as monitoring oneself while speaking or listening is an adaptive way of ensuring successful communication. Thus, children who have more friends may be better monitors in social situations.

In order for children to be able to communicate effectively they must learn not only the language itself but also the social components of speech (Krauss & Glucksberg, 1977). Social speech takes into account the knowledge and perspective of another person as well as the context of the conversation.

Krauss and Fussell (1991a, 1991b) noted that a speaker's ongoing assessment of what the "common ground" (or mutually shared information) was between themselves and the listener is continuously being modified on the basis of additional evidence. Communicative success relies, in part, on one's ability to take the perspective of others in order to monitor the common ground. Therefore, a crucial aspect of being a good communicator is the ability to be a good monitor.

In order to communicate effectively with a very young child, for example, a speaker is well advised to use simpler vocabulary and try to use terms the child will recognize. This involves the ability to imagine what it is like to be a young child trying to attend to the message as given as well as the modification of one's utterance in accordance with the knowledge of the audience. Indeed, even young children are able to make such changes in their speech (Maratsos, 1973; Shatz & Gelman, 1973).

However, relatively little is known about the process by which speakers are able to take into account the listener's perspective. Krauss and Fussel (1991a, 1991b) proposed that communicators draw on two sources of information: (1) prior beliefs of the speaker; and (2) verbal or nonverbal feedback of the listener. It is this second source of information that is of particular interest in the current study because it reflects the process of social-cognitive monitoring.

Thus, the development of communication skills involves aspects of monitoring, both as described in social psychology by Snyder and within cognitive psychology. Indeed, communication skills are social, cognitive and metacognitive in nature. The proposed MPM will allow for the assessment of the component processes of monitoring using a communication monitoring paradigm. There are, however, reasons apart from communication skills why different individual patterns of monitoring and self-monitoring abilities might arise.

<u>Individual Differences in Monitoring</u>

Individual differences in self-monitoring behaviours may be conceptualized as differences in processes or contents of social knowledge that may or may not remain stable across contexts (Graziano et al., 1987).

As already mentioned, individual differences in self-monitoring behaviours have been reliably related to differences in the seeking out of social comparison information (Elliott, 1979; Snyder, 1974). Other individual difference correlates that have been observed include processes of social cognition (Snyder & Cantor, 1980), activity partner and friendship selection (Snyder, Gangestad, & Simpson, 1983), and number of friends (Snyder et al., 1983) to mention a few.

Snyder (1987) proposed that the roots of self-monitoring behaviour were biological (i.e., there was a genetic predisposition). On the other hand, Snyder also proposed that socialization factors played a key role in the development of self-monitoring behaviours. In this vein, Dunn, Brown, Slomkowski, Tesla, andYoungblade (1991) have found that the content of familial conversations in the home (i.e., talking about emotions and beliefs) has a significant effect on children's perceptions of social situations and their developing theories of mind. In other words, the social experience of the child and the context in which the child lives may have an influence on his/her propensity to monitor communication. The current study will investigate this possibility by considering the contribution of social experience variables to successful performance at the different components of the proposed MPM.

It may be, for example, that those children who readily vary their behaviour based upon the demands of the situation are those children whose social experiences are more extensive or more varied. This individual difference may arise because children differ with respect to their initial tendency to approach or avoid unfamiliar situations (Kagan et al., 1992). This distinguishing feature may lead to increased social experience in those children who approach compared with those children who avoid or withdraw.

Thus, there may be temperamental differences which allow more outgoing children to maintain lower levels of arousal and to maintain a broader attentional focus rendering them more socially aware and reactive than inhibited children, particularly in an anxiety-provoking setting (Kagan et al., 1992). For example, lower levels of anxiety would be expected in novel social circumstances among children who have more outgoing temperamental styles. Such lower levels of anxiety among outgoing (compared to inhibited) children would allow for the outgoing children to be able to access information in memory with respect to a whole host of social interactions thereby maximizing their competency. Inhibited children, on the other hand, would have more limited social experience as well as higher levels of anxiety thereby hindering their performance. In order to test this hypothesis, temperamental variables were gathered not only from parents but also from "on-line" ratings of anxiety.

Gathering on-line measures of the children's task anxiety also allowed for the investigation of individual differences that might emerge as a result of being subjected to a novel interaction that was also unusual. For example, it may have been that a child who was not rated as inhibited by his/her parent still *behaved* in an anxious or inhibited (not engaged with the task, neutral affect, etc.) manner in the testing situation. In order to investigate this possibility, on-line measures of task engagement and/or social engagement, positive affect and anxiety were collected in an effort to describe individual differences in task performance.

Referential Communication as a Measure of Monitoring

One of the primary functions of language is to communicate information to others with respect to particular referents (Asher, 1979). Referents can be a wide variety of things like objects (e.g., the red block), locations (e.g., the location of an object) or ideas (e.g., a concept). In each instance the goal of a speaker is to ensure that the listener can determine the intended referent from possible alternatives (Asher, 1979). There are developmental differences in terms of referential communication (RC) skills such that performance improves with age. RC skills also tend to develop later than other communication skills. For example, children's abilities to attend to how well they have understood or comprehended a communication develops much later (around 6-7 years of age) than their acquisition of functional language usage (Bonitatibus, 1988).

RC tasks typically employ one of two formats. The first is an RC task in which the child is a speaker. The second is an RC task in which the child serves as a listener. As the MPM will be assessed using an RC paradigm in which the child serves as the listener, this RC format will now be described in more detail.

In a typical RC task in which the child is the listener, he/she is given a set of referents (e.g., an array of blocks) and is asked to follow directions regarding them (e.g., "pick the red one"). Some of the directions are inadequate because they are ambiguous (e.g., there may be two red items) and other directions are adequate by virtue of the fact that they refer to a single referent.

There are interesting developmental differences observed in such RC tasks. For example, preschool children are less likely than older children to detect or be confused by ambiguities and other types of communication inadequacies (Flavell, Speer, Green, & August, 1981; Singer & Flavell, 1981). Younger children also seem incapable of grasping the implications of message failures and they tend to blame the listener (i.e., themselves), as opposed to the speaker or his/her message, for miscommunications (Robinson, 1981).

Flavell and his colleagues have argued that young children's difficulties with evaluating the message itself stems from their inability to think of an utterance as an object of thought. In other words, young children lack the metacognitive capabilities of representing spoken words as objects (Flavell et al., 1981).

Other researchers (e.g., Olson, 1981) have proposed that difficulties arise because of younger children's difficulty distinguishing a literal from an intended meaning. In other words, in an RC task in which the child is given an ambiguous message, he/she may presume that there is an intended referent and readily select an item rather than evaluate the message itself for the information it conveyed. Along these lines, Bonitatibus (1988) found that the essential difference between good and poor comprehension monitors was the degree to which the child attended to the literal meaning of the utterance. He found that good comprehension monitors spontaneously recognized when it was important to attend to the literal information and not simply the gist of the message. That is, children who monitor their comprehension well do not automatically assume understanding. They engage in a more controlled process to attend to the situation as it unfolds.

The recognition that miscommunications may be a result of one's intentions not being articulated clearly is a crucial aspect of successful communication. Language is inherently ambiguous and the relationship between the reference (verbal expression) and the referent (the thing referred to) is equivocal in nature (Krauss & Glucksberg, 1977).

Adults are often aware of when the message they wish to convey is not being clearly understood by a listener and when they have not understood a message given to them. However, whether young children recognize that differences between literal and intended messages exist such that encountered misunderstandings may be due to their own faulty monitoring of a social interchange has been the focus of much research (e.g., Astington, Harris, & Olson, 1988; Beal & Flavell, 1984; Robinson, Goelman, & Olson, 1983). It may be that young children are capable of understanding that there is some sort of problem with an utterance but that they lack the cognitive resources to self-correct by enacting the proposed MPM. In other words, there may be a discrepancy between what the child thinks, and how he/she responds behaviourally in an unfolding social situation.

The Current Study

Dodge (1986, p.80) proposed that the strongest predictions concerning the relationship between cognitive processes and social behaviour should come from assessments of cognitive processes in one situation and behaviour in the same kind of situation. This position recognizes the great degree of situation specificity in behaviour. Dodge's model is concerned with how children process social information in order to respond accordingly in social situations.

Thus, a major goal of the current study was to assess performance on a cognitive task designed to tap each component step of the MPM independently in order to assess which of the four steps would be most predictive of behaviour in a naturalistic observation. Similar to Dodge (1986), the MPM was developed based upon the assumption that an individual's awareness of such processing occurs only in novel or complex tasks or when a situational cue draws attention to an otherwise automatic or script-based process.

The coherent conceptual frameworks which arise from one's experiences are known as schemas. Schemas for specific events are referred to as scripts (Schank & Abelson, 1977). Schemas arise from the child's experiences with the world which, in turn, influence how the child encodes, makes inferences about and subsequently retrieves information about particular events (Hudson, Fivush, & Kuebli, 1992). Even after a single episode a child may form a cognitive schema of what is likely to happen in a particular setting (e.g., when s/he goes to a restaurant).

Children's first scripts appear relatively early in development with most children having several scripts by the time they enter school (Hudson et al., 1992). The formation of scripts allows the individual to expect that, given a particular situation, certain prescribed events will be likely to occur. Script knowledge is accessed in a relatively automatic fashion. It is only in situations which are novel, complex, or important to the individual, that the child should engage in the steps of the proposed MPM rather than relying on the enactment of a script (Hudson et al., 1992).

However, after an initial exposure to a new situation, there is a revision of the original script the child had for an event in order to accommodate these new experiences. This continual updating of information due to social experience allows for the next similar experience to proceed more automatically. Hence, with more experience there would presumably be less need to monitor. Thus, the naturalistic task was designed to be a novel situation for all children so that adaptive performance did not depend on the enactment of a script.

Purpose

The purpose of this study was to assess the usefulness of the proposed *Monitoring Process Model* (MPM) in order to describe at which stage of processing children would be most likely to have difficulty monitoring themselves. Another goal was to investigate the possibility of a thought-behaviour discrepancy in monitoring in both a social cognitive and a naturalistic task in children. A third goal was to examine cross-domain continuities and discontinuities in monitoring using a social cognitive Lego Task and a naturalistic Birthday Task.

Hypotheses

Four hypotheses were investigated. It is known that performance on referential communication tasks improves with age (e.g., Flavell et al., 1981). So the first hypothesis was that there would be developmental differences in each of the four steps of the MPM (**assessment, evaluation, planning** and **behavioural control**) as tested by the Lego Task. Older children were expected to outperform younger children in each component.

Second, it was expected that each successive component of the MPM would better predict cross-domain performance in the naturalistic Birthday Task. Moreover, it was predicted that the fourth step of the MPM (**behavioural control**) would be most predictive of naturalistic behaviour. In other words, being able to control or modulate one's behaviour during a social-cognitive task would be most predictive of appropriate social behaviour in the naturalistic task.

It is known that there are age differences in processing capacity due to developmental and maturational constraints on working memory (e.g., Case, 1978,1985;

Siegel & Ryan, 1989). Some researchers have suggested that these capacity-based differences may in turn help to explain the thought-behaviour discrepancy in children. With this in mind the third hypothesis was that even those younger children who were successful at MPM-4 **(behavioural control)** would be less likely to change their behaviour in the naturalistic task than older children. It was expected that this age difference would emerge due to the increased processing demands of the naturalistic task.

The fourth hypothesis consisted of several anticipated differences in performance that were expected to relate to individual difference variables. It was expected that temperament would enhance the prediction of task performance as it is known that temperamentally inhibited children do not adjust to novel situations as well as their extraverted peers (Kagan et al., 1992). As the Lego Task and the Birthday Task were relatively novel it was expected that performance would be affected by the child's temperamental style. Social experience was expected to play a role in task performance in that it was expected that those children who had more friends and more home experience talking about emotions would perform more competently in the Lego Task and the naturalistic Birthday Task. Children who had an expressive language acquisition style as opposed to a referential language acquisition style were expected to be better monitors across domains. These individual difference measures were also expected to be predictor measures of appropriate social behaviour in the naturalistic task. Measures of receptive vocabulary and Digit Span which are thought to be related to general intelligence were also expected to be associated with task performance.

Method

Participants

Children were recruited from two local school boards. Letters were sent home to parents explaining the nature of a study on "Children's Communication Monitoring". Interested parents were asked to sign an attached consent form and return it to their child's teacher within one week. Consent forms were returned to the primary investigator and mutually convenient appointments were arranged by telephone.

The final sample was comprised of 24 younger children (14 males and 10 females) ranging in age from 4 years 4 months to 6 years 5 months (M =4 years 8 months; SD =5.5 months) and 24 older children (11 males and 13 females) aged 6 years 10 months to 8 years 11 months) (M =7 years 4 months; SD =6.9 months).

Materials and Procedure

All of the participants came to Brock University accompanied by at least one of their parents. Two experimenters, the primary investigator (E) and a confederate (C), met all participants in a waiting area at the University. All procedures were explained to the participants in terms appropriate for their ages before they were taken to a nearby playroom where all of the testing sessions occurred.

The children were told that first they would be going to the playroom with the C and that the C would be talking to them for a little while. It was explained to the children that the E would be joining them in the playroom after she had settled their parents in the adjoining room with some paper work. Children were also told that they could see their parent(s) at any time and that they could stop at any time if they did not want to continue with the study. All participants and their parents signed a consent form. In the few cases where young children could not print their name they were asked to print the first letter of their name. Parents were present when their children gave consent.

Children were again reassured before entering the playroom with the C that their parent(s) would remain in the adjacent room. Inside the playroom there was a card table with two chairs and a third chair was positioned in a corner of the room. The playroom was also equipped with a one-way mirror and a microphone so that all sessions could be videotaped with a camera positioned in the adjacent room. Attention was not drawn to the mirror or microphone unless the child specifically asked about them. All parents observed their child's testing sessions through the one-way mirror while filling out three questionnaires. The first questionnaire pertained to demographic information such as the the number of friends each participant had. The second questionnaire was the Family Talk Survey in which parents were asked to describe language use in the home as well as their child's style of language acquisition. The third questionnaire was the EAS temperament survey which is comprised of three factors: emotionality, activity level, and sociability (see Appendix A, pp. 117-122). Each child completed the tasks in the same order in a single testing session that lasted approximately one hour. The tasks will now be described in order of presentation.

Naturalistic Birthday Task

Upon entering the playroom, the C told the child he/she could sit in the chair that was positioned facing the one-way mirror although not directly in front of it so that when the child was seated he/she was not looking at his/her reflection. The C then sat in a chair to the child's left so the child's face was not obscured from view. When the child was seated and comfortable the C initiated a semi-structured conversation with the child.

First the C engaged the child in an ordinary, pleasant conversation. Questions similar to those that occur in uneventful social interchanges were asked (e.g., "What is your name?", "How old are you?", etc.). The questions asked by the C were similar in nature for all participants and they were asked in a similar order leading to a question regarding birthdays. The children were asked "Have you ever had a birthday party?". If a child said no then the child was asked if he/she had ever been to a birthday party. None of the children answered no to both these questions. Next children were either asked to describe their last birthday party or the last birthday party they had attended as appropriate (see Appendix A, pp. 123-124 for details).

Initially the C made conversationally appropriate responses to what the child said. However, after a few minutes, the C proceeded through a hierarchy of response cues reflecting increasing puzzlement with what the child said. At the first level of responding (GESTURE), the C looked puzzled and gestured (e.g., shrugged shoulders, furrowed eyebrows) following a statement given by the child. At level two (REPEAT + LOOK) the C looked puzzled and repeated what the child said in a questioning tone. At the third level (VERBAL PROMPT), the C made specific verbal requests for clarification of what the child meant by a particular verbalization (e.g., "I don't understand..." or "What do you mean?..."). At the fourth level of responding (BIZARRE PROMPT), the C made situationally inept responses that were loosely tied to what the child said although inappropriate (e.g., "It's really great when you get to eat grass on your birthday"; "You're right, the best part about birthdays is when nobody comes to the party"). Finally, the C displayed an inappropriate, flattened affect (SAD LEVEL) accompanied by an unexpected verbalization ("Talking about birthdays always makes me sad").

Conversationally appropriate utterances were interspersed throughout the Birthday Task, five of which were chosen at random and were coded as the 'NORMAL' level. The SAD level signalled the end of the Birthday Task at which point the E entered the room after a 20 second delay.

Debriefing

The E then entered the playroom and noticed the flattened affect of the C and asked if she would like to get a glass of water. At this point the C left the playroom allowing for the E to sit in the C's chair beside the child and debrief him/her about the preceding birthday conversation (see Appendix A, p.125 for the debriefing protocol). Following this interchange the C returned to the playroom displaying a positive affect and said "I was having a bit of a bad day but I had a glass of water and I am feeling much better now".

This was done in order to minimize any feelings that the C was silly or not to be trusted. This should also have alleviated any guilt feelings the child may have had concerning making the C sad. The C then explained to the child that she had some work to do and was going to do it in the playroom. The C then took a seat in the third chair in the playroom which was positioned to the child's right about 1.5 metres from the card table where the child and the E were seated. Both the C and the E were present for the administration of the Lego Task.

MPM Lego Task

Next the children were given a problematic referential communication task which was modelled after the paradigm of Flavell et al. (1981). The E told the children that she had made some buildings out of Lego blocks earlier in the day and she had written down the directions for how to build them. She then asked the children if they could follow the directions to make Lego buildings that looked exactly like the ones that she had made earlier in the day (see Appendix A, pp.126-132 for full instructions).

The blocks used were relatively large easy to handle Lego-type blocks. The first two structures the child built were simpler practice trials in order to confirm that the child knew his/her colours (white, blue, red, green and yellow) and could distinguish big from small (the two different sizes of blocks used). Upon completion of each of the two practice buildings E showed the children a replica of the buildings that the children were to have made. This allowed for the children to make direct comparisons between their building and the one that E had made. Feedback about performance was given to the children for these two practice trials. Feedback was not given for the test trials.

Each of the five test trial buildings was at approximately the same level of difficulty. Each building had a base that was already assembled and to which the child was asked to continue to place blocks to replicate a series of buildings that the E had made earlier in the day. Five instructions were given for each building in random order. There were three clear and easy to follow directions (e.g., "put the small white block on top of the big blue block"). There was one referentially ambiguous direction (e.g., "put the red one on top of the small green one"-when there were two red blocks of different sizes available), and one impossible direction which included nonwords (e.g., "now put the horzingloffen beside the building").

After each test trial was finished the children were asked to evaluate their building with respect to how it compared to the building that the E had made earlier. Children were not shown models of what the test trial buildings were supposed to look like because "there were not enough blocks" to make two of every building. Children were asked three questions following each building. The first question was "Do you think your building looks exactly like the one I made earlier today?" to which children responded yes or no. Second, children were asked "How sure are you?" at which point they were shown a visual Likert scale with 5 happy face line drawings on it. The happy face figures ranged in size from small (numbered 1) to large (numbered 5) (see Appendix A, p.133). Children were told that they were to point to happy face number 1 if they were a little bit sure and to point to number 3 if they were medium sure and to point to happy face number 5 if they were very sure that their building looked exactly like the one that the E had made earlier in the day. Finally, children were asked "How do you know?" referring to how the child knew that his/her building looked like the one that E had made.

There were five test trial buildings. The first building served as a control or baseline trial and the four remaining test trial buildings were designed to assess each of the four components of the MPM independently. All children built the buildings in the same fixed order beginning with the baseline building and then progressing through the four levels of the MPM. The C was responsible for varying the levels of the MPM by giving the children increasingly more obvious information regarding the ambiguous directions they were getting (see Appendix A, p.134 for a list of prompts given by the C). After the Lego Task was completed, the C told the children that her work was finished at which point she left the playroom. Only the E and the child were present for the remainder of the tasks.

Working Memory Sentences

A sentence completion task in which children were read a series of sentences with the last word omitted was used in order to measure children's verbal working memory capacity (Siegel & Ryan, 1989). The task was for the children to supply the missing word and then repeat all the missing words given at each level. A series of progressively more difficult levels (more sentences read) was used. There were three trials at each level (2,3,4, and 5) yielding a minimum score of zero and a maximum possible score of 12. Task administration was stopped when the child failed to recall all words supplied for the ends of the sentences at one level (see Appendix A, pp. 135-137).

Digit Span

Wechsler's (1974) digit span test from the WISC-R served as a measure of general attentional capacity (see Appendix A, p.138). The E read aloud sequences of digits that the child was asked to repeat aloud immediately in the proper sequence. Two sequences were read aloud to the child at increasingly difficult levels beginning with a sequence of two digits. If one or both sequences at this level was repeated correctly then a new sequence with one more digit to repeat was read aloud. If neither of the two sequences was repeated correctly then the task was stopped. The score the child received was based on the number of correctly repeated sequences.

Receptive Vocabulary Task

Participants were then given the Peabody Picture Vocabulary Test-Revised (PPVT-R) a well-established test of receptive vocabulary (Dunn & Dunn, 1981). During the administration of this task, children heard a word and were then asked to point to one of four pictures they thought best told the meaning of the word said by E. This task was administered and scored according to standard procedures as outlined by Dunn and Dunn (1981).

Number Identification

The last task was a short number identification task. The purpose of this task was to allow children to leave the playroom feeling positive about their performance. It was easy for all children to be successful in this task. Younger children saw a series of five cards each with a printed number on it and they were asked to tell E what number appeared on the card. Older children saw five cards that had simple addition questions (e.g., 2+2=?, 5+1=?). All children received positive feedback about their performance on this task.

Following the number identification task, children were asked if they had any questions about the study and they were thanked for their participation. They were then taken into the observation room to see their parent(s) and a small portion of the videotape that had been made.

Scoring of Novel Tasks

The birthday and Lego Tasks were scored from the videotapes. For the Birthday Task each child received an overall competence rating of 1-5 for each of the six levels of response cues given by the confederate (GESTURE, REPEAT + LOOK, VERBAL PROMPT, BIZARRE PROMPT, SAD AFFECT, and NORMAL LEVEL)(see Appendix A, pp. 139-140 for coding criteria for overall competence measures). The time on the tape for administration of each of these levels was recorded.

Next, the tapes were coded in 20 second epochs, 10 seconds immediately prior to each level of response cue ("pre" scores) and 10 seconds immediately following each level of response cue ("post" scores). Pre and post epochs were coded separately for the dimensions of social engagement, positive affect and anxiety. These three dimensions were chosen on the basis of their theoretical importance to the processes of social cognition.

For example, it has been suggested that behaviour is shaped substantially by personal goals (e.g., Fiske & Taylor, 1991). Thus a measure of a child's on-line engagement with the conversation was rated as it was thought to reflect the degree of motivation to continue with the Birthday Task. While this was not a direct assessment of the task goal it did provide an index of the child's degree of motivation to continue with the conversation. Second, because poor mood has been linked to rigid strategies of social interaction by Showers and Cantor (1985), a measure of positive affect was rated in order to reflect the child's enjoyment with the task and to also provide an indication of his/her willingness to be flexible in dealing with the C. Third, on-line ratings of the child's anxiety levels allowed for the investigation of temperamental differences which may have influenced performance on novel tasks.

All pre and post dimensions were rated on a scale of 1-5. Social engagement was coded based on behaviours thought to indicate the child's motivation to continue the birthday conversation, degree of interest in the C, timely response to questions and eye contact versus eye movement around the room. Affect referred to the children's positive affect with the task and their apparent enjoyment of the conversation. Anxiety was coded as the number and degree of anxious behaviours displayed by the child and these included repetitive movements that could be coded based on standard criteria (see Appendix A, pp.139-142 for a detailed description of coding criteria).

Inter-rater agreement for the Birthday Task was established on 20% of the data selected at random. For the overall competence ratings there was 78% agreement between raters. However, inter-rater agreement for the pre-post measures were not as good: 72% for social engagement, 70% for affect and 69% for the anxiety dimension. While these inter-rater agreement values are on the borderline of acceptability, analyses were undertaken using the 5-point ratings as the overall competence rating was the most important variable in terms of the major hypotheses and it had the highest reliability. Moreover, for the analyses prescores were covaried from post scores to create a residualized measure so that the actual raw numbers on which percent agreement was established were not used in the regressions.

Similarly, the Lego Task was also scored from the videotapes. Each child received a score of 1 (correct) or 0 (incorrect) for block placement for the clear instructions, and a score of 1-5 for their response to the ambiguous and impossible (problematic) instructions. A rating of one for the problematic instructions indicated that the child did not appear to notice and places a block without question or hesitation while a rating of five was reflective of the most competent response in whereby the child asked the E for assistance. Inter-rater agreement was again established on 20% of the videotapes chosen at random. There was 86% agreement for responses to the ambiguous instructions and 90% agreement for responses to the impossible instructions (see Appendix A, pp. 143-150 for further details about scoring criteria).

Twenty second epochs were scored for the Lego Task on the dimensions of task engagement, social engagement, affect and anxiety for each of the five test trial buildings. The first 10 seconds following the first instruction given for each building comprised the "pre" scores while the last 10 seconds prior to the probe questions comprised the "post" scores. Inter-rater reliabilities were established for each of the four pre-post dimensions (mean percent agreement for the pre score and the post score). Agreement between the raters was acceptable for all dimensions: 88% for task engagement, 85% for social engagement, 85% for affect and 85% for anxiety.

Inter-rater reliability was much better for the Lego Task than the Birthday Task. This was likely due to the fact that there were two different reliability raters (one for the Lego Task and one for the Birthday Task).

Results

Age and Sex Differences on Working Memory, Digit Span and PPVT-R measures:

The older children outperformed the younger children on all three well-established psychometric measures. Older children recalled more words on the Working Memory task, were able to repeat more Digits, and had higher vocabulary scores as measured by the PPVT-R (raw scores) than the younger children. Means, standard deviations and univariate t-tests are summarized in Table 1. An alpha level of .05 was used for all a priori statistical tests.

Insert Table 1 about here

Insert Table 2 about here

Zero order correlations between these indices are presented in Table 2. There were no sex differences observed on any of these tasks: $t(46) = .01$, $p = .990$ for Working Memory, $t(46) = -.03$, $p = .976$ for Digit Span and $t(46) = .41$, $p = .684$ for the PPVT-R.

Table 1.
Means and Standard Deviations for Working Memory Sentences, Digits and PPVT-R as a function of Age.

Variable	Mean	SD	N	t	p
Working Memory					
Young	0.63	1.06	24	7.99	<.001
Older	3.54	1.44	24		
Digit Span					
Young	4.08	1.32	24	3.64	.001
Older	5.58	1.53	24		
PPVT-R					
Young	62.33	14.86	24	-8.29	<.001
Older	94.21	11.56	24		

Table 2.
Correlations among Age, Working Memory, Digit Span and PPVT-R

	AGE	Working Memory	Digit Span	PPVT-R
AGE	1.00			
Working Memory	0.79***	1.00		
Digit Span	0.49***	0.44**	1.00	
PPVT-R	0.80***	0.74***	0.54***	1.00

Note.
**$p < .01$. ***$p < .001$.

MPM Lego Task

Age and Sex Differences for Problematic Lego Instructions

There were two types of problematic instructions given for each of the five Lego test trial buildings. One type of problematic instruction was referentially ambiguous while the other type of problematic instruction was impossible. Children were rated on a scale of 1 (child did not appear to notice and placed a block without question or hesitation) to 5 (most competent response in which the child asked E for assistance) with respect to their overall competence of response for both these problematic instructions for all five buildings. Thus, a child could receive a maximum overall competence rating of 25 for both ambiguous and impossible types of instructions.

Older children (M = 16.67, SD = 5.74) responded more competently to the ambiguous instructions than the younger children (M= 11.17, SD = 6.49), $t(46)$= -3.11, p < .01. However, the age groups did not differ significantly with respect to mean competence of response to the impossible instructions (M = 18.21, SD = 3.87 vs. M = 16.21 , SD = 4.47 for the older and young children respectively, $t(46)$= -1.66, ns). There were no sex differences observed in terms of overall competence of response for either type of problematic instruction.

Age Differences in MPM Lego Task Success

All children were rated as either being successful or not successful for each of the five Lego test trial buildings based on a competence rating of three or higher for both the ambiguous and the impossible (problematic) instructions. This criteria ensured that the child noticed the problematic instruction as a rating of three was based on the criterion of a hesitation before block placement of at least three seconds although they did not have to verbally seek information from the E for this rating.

There was no significant difference between younger and older children in terms of how many children were successful in the control condition in which the C offered no prompt in response to the ambiguous instruction $\chi2(1, \underline{N} = 48) = 3.09$, ns. Similarly, the number of children who were successful did not differ between groups for MPM-1 (**assessment**) when children were told "that's a problem" $\chi2(1, \underline{N} = 48) = 3.63$, ns.

However, at each of the remaining levels of the MPM there were significant associations between age and success such that more older children were successful than younger children.

Moreover, the significance levels of the associations between age and success increased with each successive building. For example, at MPM-2 (**evaluation**) when children were told "That's a problem. You have more than one white block" older children performed significantly better than younger children $\chi2(1, \underline{N} = 48) = 4.46$, $\underline{p} < .05$. Again at MPM-3 (**planning**) older children were more likely to be successful than younger children when prompted "That's a problem. You have more than one red block. What could you do about that?" $\chi2(1, \underline{N} = 48)= 12.00$, $\underline{p} < .001$. Finally, at MPM-4 (**behavioural control**) when children were told "That's a problem you have more than one white block what could you do about that? I guess you could ask her to repeat what she said or you could pick one of the two white blocks, or you could ask her which one she means" the age differences were highly significant $\chi2(1, \underline{N} = 48) = 16.80$, $\underline{p} < .0001$. (See Figure 1).

Number of Successful Children for each Lego Building

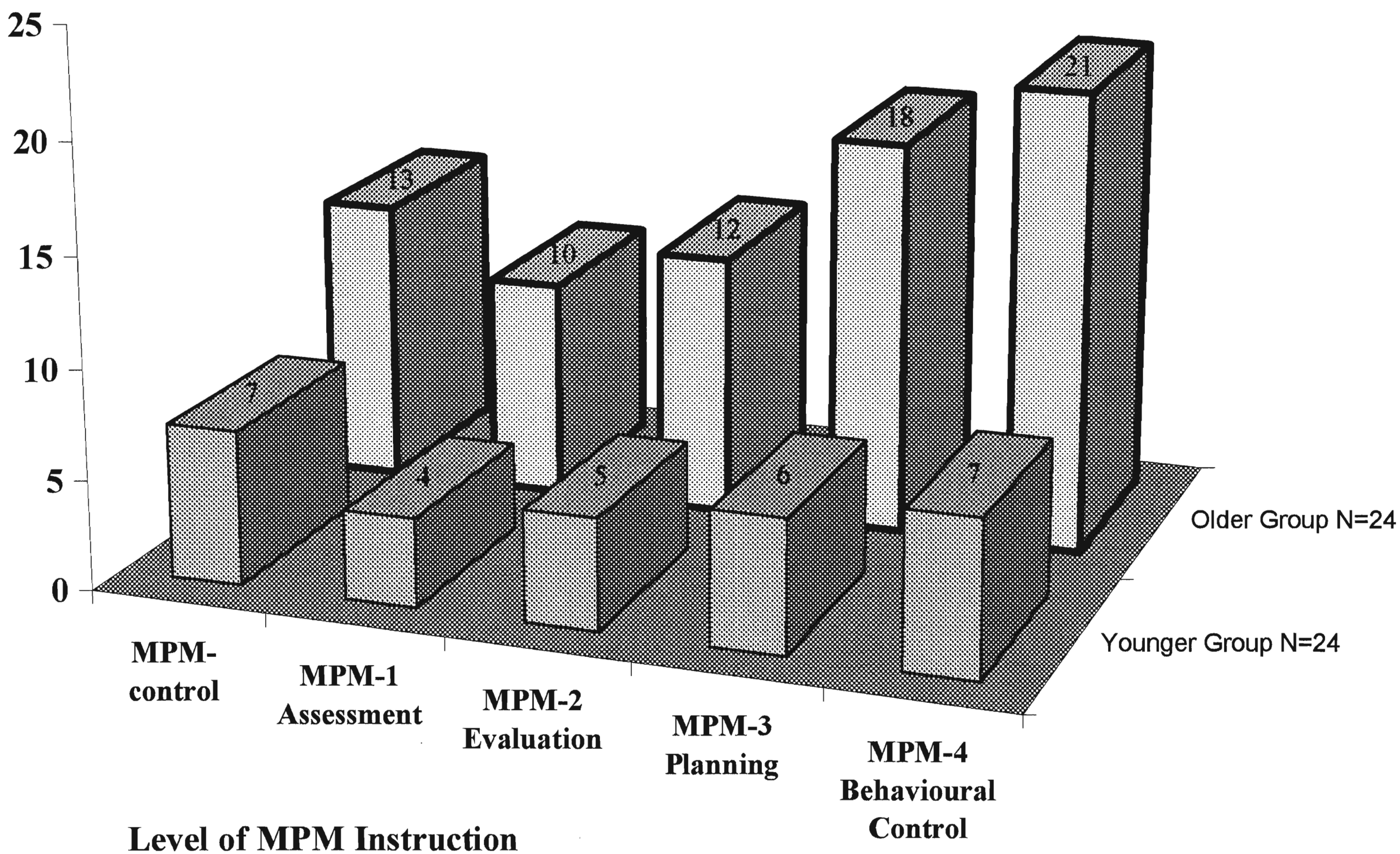

Figure 1

In order to test the significance of the interaction between age group and performance for each Lego test trial, a 2 (Group) by 5 (Building) repeated measures ANOVA was performed. Here, rather than using a categorical index of success, the child's competence ratings for each of the ambiguous and impossible instructions were summed to yield a Building score that had a maximum value of 10. There was a significant effect of age Group $F\ (1,46) = 8.11$, $p = .007$ such that older children had higher competence ratings for the problematic instructions than the younger children. There was a significant effect of Building $F\ (4,184) = 8.19$, $p < .001$ in that responses to the problematic iunstructions varied depending on the trial (**MPM-control** trial to MPM-4 **behavioural control** trial). The Group by Building interaction was also significant $F\ (4,184) = 2.70$, $p = .032$. Means and standard deviations for each Lego building trial are shown in Table 3.

Insert Table 3 about here

Table 3.
Means and Standard Deviations for Competence Ratings to Problematic Instructions for each Lego Building as a Function of Age

Lego Building	Mean(SD)	N	t	p
MPM-Control				
Young	5.42(2.13)	24	-2.47	.017
Older	6.92(2.08)	24		
MPM-1 Assessment				
Young	5.67(1.71)	24	-1.52	.135
Older	6.46(1.89)	24		
MPM-2 Evaluation				
Young	4.92(2.69)	24	-1.71	.094
Older	6.13(2.19)	24		
MPM-3 Planning				
Young	5.58(2.47)	24	-2.30	.026
Older	7.08(2.04)	24		
MPM-4 Behavioural Control				
Young	5.79(2.75)	24	-3.92	<.001
Older	8.29(1.49)	24		

Note.
The maximum combined competence rating for both ambiguous and impossible instructions was 10 for each Lego building test trial.

Birthday Task

Aggregation of Data in the Birthday Task

In the Birthday Task, some of the levels of response cues were given more than once. Originally there were two separate levels of verbal cues "I don't understand" versus "What do you mean?..." . Overall competence ratings to these levels did not differ significantly $t(17) = .00$, $p = 1.00$, so these levels were collapsed to form a single verbal response cue level. Similarly, the two bizarre prompts "It's great when you get to eat grass..." and "The best part about birthdays is when no-one comes to the party" were also collapsed to form one level of bizarre response cue. Again, there was no significant difference in terms of overall competence ratings to the bizarre prompts $t(46) = .70$ $p = .769$. Moreover, all of the children were given five 'normal' level prompts which were interspersed throughout the task. The mean competence rating for the five normal utterances served as a single NORMAL LEVEL score.

Thus, after combining these levels, the end result was six levels of Birthday Task response cues (GESTURE, REPEAT + LOOK, VERBAL PROMPT, BIZARRE PROMPT, SAD AFFECT and NORMAL LEVEL). These six levels will be used for all subsequent analyses of Birthday Task performance.

Age and Sex Differences Across Levels of Birthday Task

Each child was given an overall competence rating of 1 (child did not appear to notice or acknowledge the utterance) to 5 (most competent response) for each of the six levels of the Birthday Task (see Appendix A for a detailed description). As shown in Table 4, several age differences were observed in terms of overall competence of responses. For example, older children scored higher in terms of their overall competence measure for three of the six levels of the Birthday Task: REPEAT + LOOK, VERBAL PROMPT and SAD AFFECT. There were no significant differences between the groups for the GESTURE, BIZARRE PROMPT or NORMAL LEVEL response cue levels. Means, standard deviations and univariate t-tests are shown in Table 4.

Insert Table 4 about here

Table 4.
Means and Standard Deviations for Overall Competence ratings for all Levels of the Birthday Task as a Function of Age

Birthday Task Level	Mean(SD)	N	t	p
Gesture				
Young	1.90(0.79)	20	-1.53	.135
Older	2.45(1.44)	22		
Repeat + Look				
Young	2.43(1.04)	23	-2.51	.016
Older	3.30(1.29)	23		
Verbal Prompt				
Young	3.57(1.26)	23	-4.20	<.001
Older	4.75(0.55)	24		
Bizarre Prompt				
Young	3.83(0.97)	24	-0.75	.458
Older	4.02(0.74)	24		
Sad Affect				
Young	3.08(1.08)	24	-2.35	.023
Older	4.54(0.88)	24		
Normal Level				
Young	4.38(0.61)	24	-1.22	.230
Older	4.57(0.42)	24		

MPM Lego Task as a Predictor of Birthday Task Performance: Univariate analyses

In order to predict Birthday Task performance from Lego Task performance, children were divided into two groups (successful vs. unsuccessful) for each of the five Lego test trial buildings. Age and sex were covaried from all analyses in order to ascertain how well Lego Task success predicted Birthday Task performance independent of these two variables.

Children who were successful in the Lego Task consistently performed better than those children who were unsuccessful in two of the six levels of the Birthday Task (REPEAT + LOOK and VERBAL PROMPT). These significant differences in Birthday Task performance emerged for each Lego building. The SAD AFFECT level differed by group for three of the five Lego buildings; MPM control, MPM-1 **(assessment)** and MPM-2 **(evaluation)**. Means, standard deviations and univariate F's for all six levels of the Birthday Task as a function of Lego building success can be seen in Tables 5 through 9.

Insert Tables 5,6,7,8 and 9 about here

Table 5.
Means for overall competence of response across levels of the Birthday Task as a function of success with MPM control level

Lego Task Performance	Level of Birthday Task	Mean (SD)	F(2,37)	p
Unsuccessful	Gesture	2.00(1.12)	1.00	.38
Successful		2.56(1.26)		
Unsuccessful	Repeat + Look	2.52(1.12)	4.03	.03
Successful		3.50(1.34)		
Unsuccessful	Verbal Prompt	3.80(1.26)	10.55	<.001
Successful		4.75(0.58)		
Unsuccessful	Bizarre Prompt	3.92(0.77)	1.35	.27
Successful		4.03(0.81)		
Unsuccessful	Sad Affect	4.12(1.05)	4.31	.02
Successful		4.56(0.73)		
Unsuccessful	Normal	4.43(0.58)	0.98	.38
Successful		4.53(0.50)		

Note.
All F's are univariate differences between means for each level of the Birthday Task as a function of Lego Task success.
N = 25 Unsuccessful and N = 16 Successful for MPM control.

Table 6.
Means for overall competence of response across levels of the Birthday Task as a function of success with MPM 1- Assessment

Lego Task Performance	Level of Birthday Task	Mean (SD)	F(2,37)	p
Unsuccessful Successful	Gesture	2.11(1.97) 2.46(1.98)	1.49	.24
Unsuccessful Successful	Repeat + Look	2.64(1.22) 3.46(1.33)	4.47	.02
Unsuccessful Successful	Verbal Prompt	3.91(1.26) 4.73(0.53)	12.32	<.001
Unsuccessful Successful	Bizarre Prompt	3.98(0.73) 3.92(0.91)	1.48	.24
Unsuccessful Successful	Sad Affect	4.14(1.01) 4.62(0.77)	4.43	.02
Unsuccessful Successful	Normal	4.43(0.55) 4.55(0.55)	0.92	.40

Note.
All F's are univariate differences between means for each level of the Birthday Task as a function of Lego Task success.
N = 28 Unsuccessful and N = 13 Successful for MPM-1.

Table 7.
Means for overall competence of response across levels of the Birthday Task as a function of success with MPM 2- Evaluation

Lego Task Performance	Level of Birthday Task	Mean (SD)	F(2,37)	p
Unsuccessful Successful	Gesture	2.12(1.24) 2.38(1.15)	1.63	.21
Unsuccessful Successful	Repeat + Look	2.72(1.28) 3.19(1.33)	5.45	<.001
Unsuccessful Successful	Verbal Prompt	3.88(1.30) 4.63(0.62)	13.12	<.001
Unsuccessful Successful	Bizarre Prompt	3.94(0.80) 4.00(0.78)	1.42	.25
Unsuccessful Successful	Sad Affect	4.08(1.04) 4.63(0.72)	4.37	.02
Unsuccessful Successful	Normal	4.35(0.55) 4.65(0.50)	1.15	.33

Note.
All F's are univariate differences between means for each level of the Birthday Task as a function of Lego Task success.
N = 25 unsuccessful and N = 16 Successful for MPM-2.

Table 8.
Means for overall competence of response across levels of the Birthday Task as a function of success with MPM 3- Planning

Lego Task Performance	Level of Birthday Task	Mean (SD)	F(2,37)	p
Unsuccessful Successful	Gesture	1.75(0.97) 2.67(1.24)	0.40	.68
Unsuccessful Successful	Repeat + Look	2.45(1.23) 3.33(1.24)	3.52	.04
Unsuccessful Successful	Verbal Prompt	3.58(1.32) 4.74(0.49)	8.63	.001
Unsuccessful Successful	Bizarre Prompt	4.00(0.80) 3.93(0.78)	1.50	.24
Unsuccessful Successful	Sad Affect	3.90(1.07) 4.67(0.66)	2.68	.08
Unsuccessful Successful	Normal	4.39(0.62) 4.54(0.46)	0.77	.47

Note.
All F's are univariate differences between means for each level of the Birthday Task as a function of Lego Task success in the planning component.
N = 20 Unsuccessful and N = 21 Successful for MPM-3.

Table 9.
<u>Means for overall competence of response across levels of the Birthday Task as a function of success with MPM 4-Behavioural control</u>

Lego Task Performance	Level of Birthday Task	Mean (SD)	F(2,37)	p
Unsuccessful Successful	Gesture	1.94(1.03) 2.42(1.28)	1.09	.35
Unsuccessful Successful	Repeat + Look	2.41(1.18) 3.25(1.29)	3.53	.04
Unsuccessful Successful	Verbal Prompt	3.38(1.28) 4.73(0.57)	7.09	.002
Unsuccessful Successful	Bizarre Prompt	3.94(0.83) 3.98(0.76)	1.45	.25
Unsuccessful Successful	Sad Affect	3.77(1.03) 4.67(0.70)	2.01	.15
Unsuccessful Successful	Normal	4.34(0.65) 4.56(0.45)	0.55	.58

<u>Note</u>.
All F's are univariate differences between means for each level of the Birthday Task as a function of Lego Task success in the behavioural control level.
<u>N</u> = 17 Unsuccessful and <u>N</u> = 24 Successful for MPM-4.

MPM Lego Task as a Predictor of Birthday Task Performance: Multivariate Analyses

It was expected that each successive component of the MPM, as tested by the Lego Task, would better predict Birthday Task performance than the previous component. Further, it was hypothesized that the fourth component of the MPM (**behavioural control**) would be the most predictive of Birthday Task performance compared to the other components of the MPM. In order to test this hypothesis five separate MANOVAs (one for each Lego test trial) were done in order to ascertain whether success at each Lego building (MPM component) was predictive of behaviour across levels of the Birthday Task.

Each MANOVA had the same pattern of analysis: there was one between subjects factor (Lego success) and one within subjects factor (the six levels of the Birthday Task). Age and sex were used as covariates in order to test the predictive value of Lego Task success independent of the children's age and sex.

Results indicated that the between subjects factor of Lego success did not have a significant effect on overall competence in the Birthday Task for the MPM control building $F(1,37) = 2.58$, ns, MPM-1 (**assessment**) $F(1,37) = 1.20$, ns, or MPM-2 (**evaluation**) $F(1,37) = 2.22$, ns. However, children who were successful at MPM-3 (**planning**) and MPM-4 (**behavioural control**) performed significantly better in terms of their overall competence ratings ($F(1,37)=5.68$, $p < .05$ and $F(1,37) = 3.99$, $p < .05$ respectively) across all levels of the Birthday Task.

As shown in Table 10 the within subjects factor of level of Birthday Task response cue was significant in each instance. However, the interaction effect of Lego success by level of Birthday Task response cue was only significant for MPM-3 (**planning**) $\underline{F}(5,195) = 2.92$, $\underline{p} < .05$ and MPM-4 (**behavioural control**) $\underline{F}(5,195) = 2.85$ $\underline{p} < .05$. See Figures 2 and 3, for the significant interactions.

Insert Table 10 about here

Insert Figures 2 & 3 about here

Table 10.
Within Subjects Effects of Level of Birthday Task and Interactions with Lego Task Success

Effects	F(5,195)	p
MPM- control		
Level	36.12	.001
Success X Level	1.74	ns
MPM 1- Assessment		
Level	32.86	.001
Success X Level	1.34	ns
MPM 2- Evaluation		
Level	36.98	.001
Success X Level	0.66	ns
MPM 3-Planning		
Level	40.69	.001
Success X Level	2.92	.05
MPM 4-Behavioural Control		
Level	39.19	.001
Success X Level	2.85	.05

Note.
N = 41 children with complete data for all MANOVAs.

MPM-3 Lego success by Level of Birthday Task Interaction

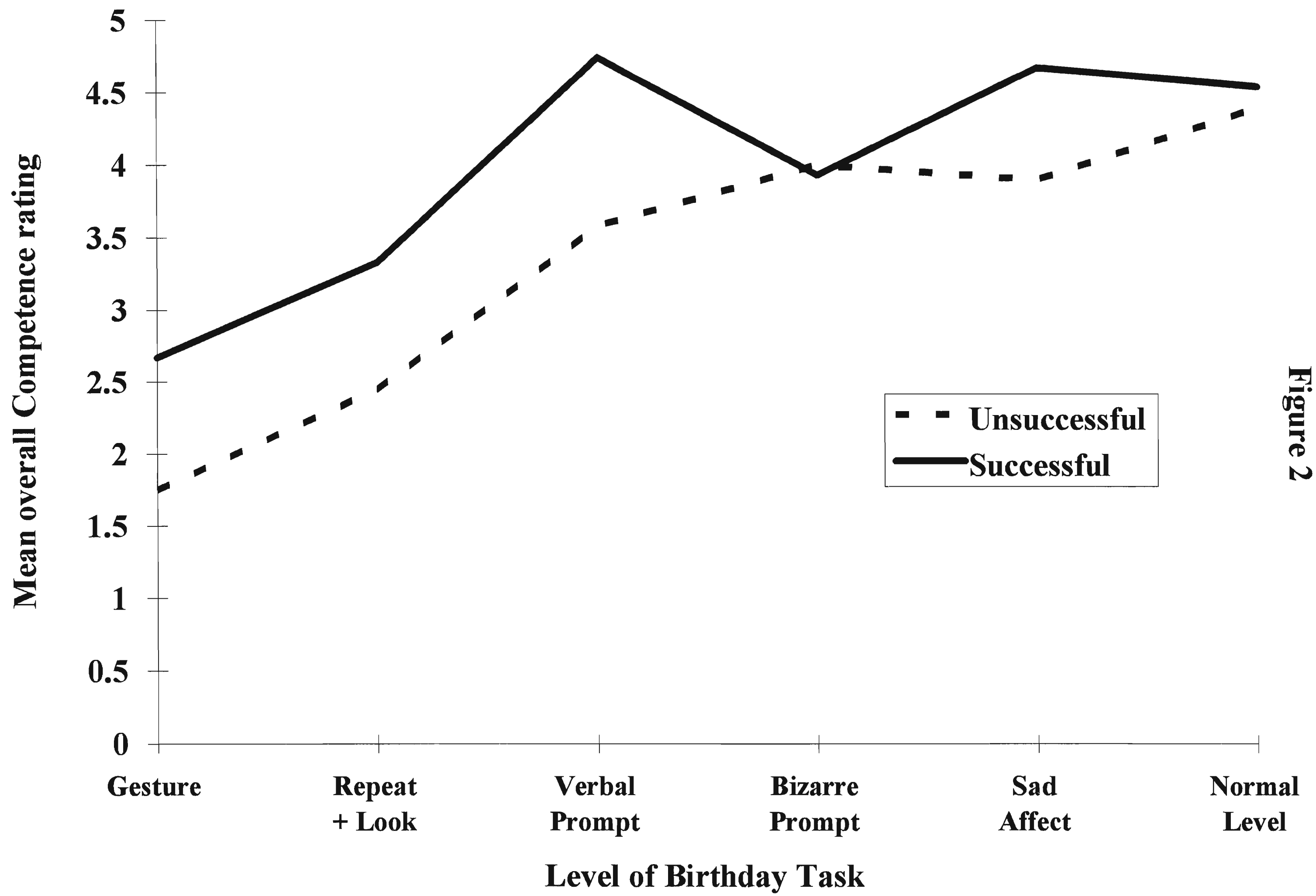

Figure 2

MPM-4 Lego success by Level of Birthday Task Interaction

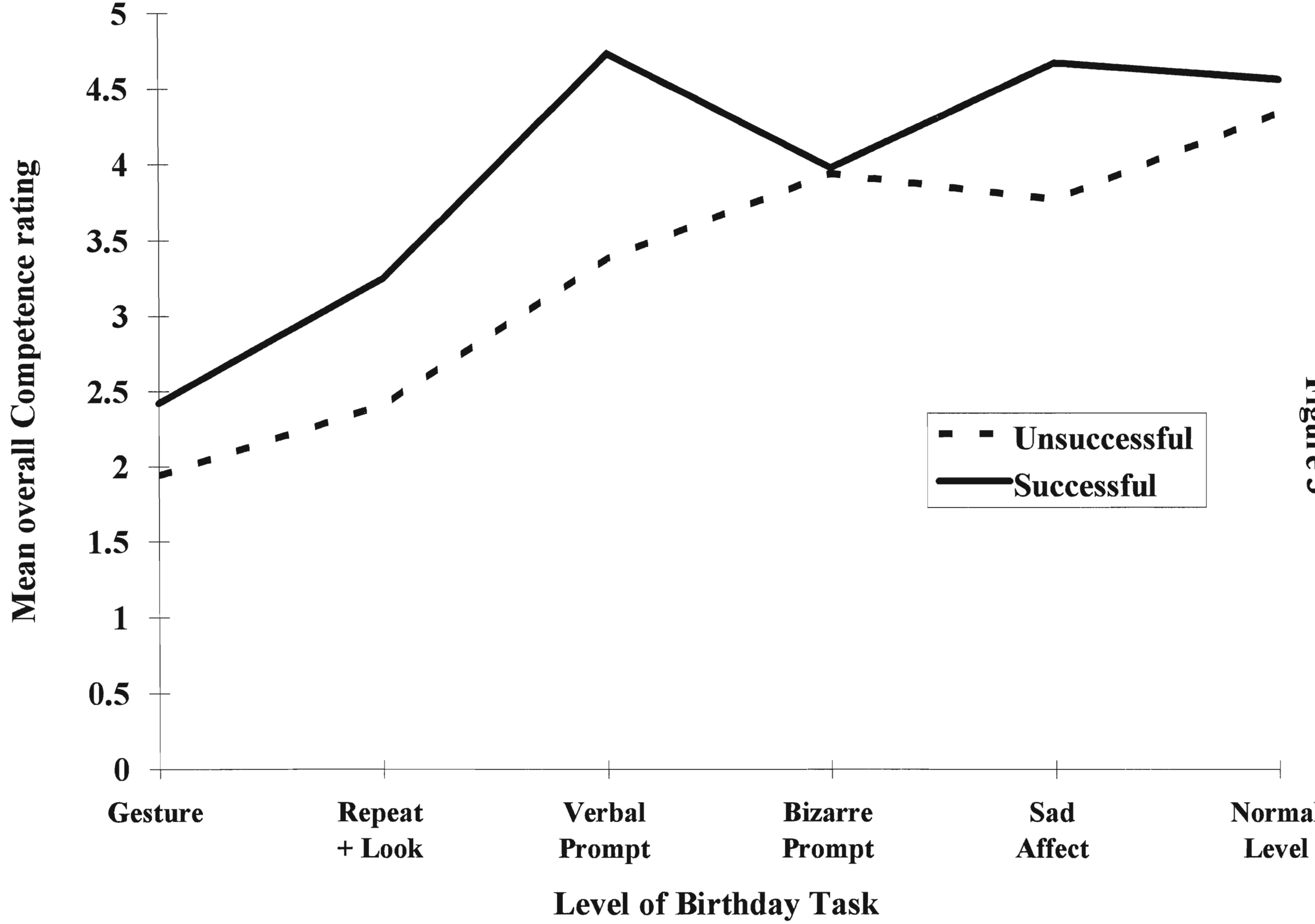

Figure 3

Success at MPM-4 (behavioural control) as it related to Birthday Task

In order to test the hypothesis that even those young children who were successful at MPM-4 **(behavioural control)** would be less competent in the more naturalistic Birthday Task due to the processing demands of the naturalistic task a 2(Group) x 6 (Level of Birthday Task) mixed design ANOVA was done using only those children who were successful at MPM-4 **(behavioural control)**. A significant age group difference was expected and a subsequent analysis covarying out working memory scores was expected to eliminate the observed age group difference.

Contrary to the hypothesis, however, there was no main effect for group $F(1,22) < 1$, $p = .969$, ns. There was a significant effect for Level of Birthday Task $F(5,110) = 17.02$ $p < .001$ and no significant Group x Level of Birthday Task interaction $F(5,110) = 0.79$, $p = .560$. As the expected group difference did not emerge between those children who were successful at MPM-4 **(behavioural control)** a further analysis with working memory as the covariate was not warranted.

Individual Differences in the Birthday Task

A series of hierarchical regression analyses in which overall competence ratings for each of the levels of Birthday Task response cue served as the criterion measure were undertaken. Age, sex and the relevant interaction term were partialled from all regressions before individual difference measures were entered on the last step.

None of the well-established measures, PPVT-R, Working Memory or Digit Span, accounted for any significant amount of variance over and above that which could be accounted for by Age and Sex. Moreover, none of the EAS temperament survey subscales, Emotionality, Activity or Sociability added to the prediction of competence ratings. Furthermore, two indices of social experience (number of friends and family talk) also failed to account for any significant unique variance in predicting children's overall competence ratings at any of the 6 levels of the Birthday Task (see Tables 11 to 18).

Insert Tables 11 to 18 about here

Table 11.
Regressions using Age, Sex, and PPVT-R as predictors of Birthday Task success.

Criterion	Variable	df	β	R sq Change	p
Gesture	Age	1	.249	.062	.112
	Sex	1	.160	.025	.306
	Age X Sex	1	.161	.000	.992
	PPVT-R	1	-.147	.007	.585
R sq Total = .095, F(4,37)= .969, p = .436					
Repeat + Look	Age	1	.447	.199	.002
	Sex	1	-.075	.006	.586
	Age X Sex	1	-.836	.036	.165
	PPVT-R	1	.171	.011	.451
R sq Total = .252, F(4,41)= 3.45, p =.016					
Verbal Prompt	Age	1	.604	.365	<.001
	Sex	1	.195	.037	.102
	Age X Sex	1	-.275	.004	.600
	PPVT-R	1	.321	.037	.102
R sq Total = .443, F(4,42)= 8.37, p < .001					
Bizarre Prompt	Age	1	.151	.023	.307
	Sex	1	.179	.032	.225
	Age X Sex	1	.529	.015	.409
	PPVT-R	1	.076	.002	.763
R sq Total = .071, F(4,43)= .824, p=.517					
Sad Affect	Age	1	.386	.149	.007
	Sex	1	.030	.001	.826
	Age X Sex	1	.443	.010	.466
	PPVT-R	1	.053	.001	.826
R sq Total = .161, F(4,43)= 2.07, p =.101					
Normal Level	Age	1	.237	.056	.105
	Sex	1	-.128	.016	.379
	Age X Sex	1	.949	.047	.130
	PPVT-R	1	.083	.002	.735
R sq Total = .122, F(4,43) =1.50, p =.219					

Table 12.
Regressions using Age, Sex, and Working Memory as predictors of Birthday Task competence.

Criterion	Variable	df	β	R sq Change	p
Gesture	Age	1	.249	.062	.111
	Sex	1	.160	.025	.306
	Age X Sex	1	<.001	.000	.999
	Working Memory	1	.244	.023	.339
R sq Total = .109, F(4,37)= 1.14, p = .352					
Repeat + Look	Age	1	.447	.199	.002
	Sex	1	-.075	.006	.586
	Age X Sex	1	-.836	.036	.165
	Working Memory	1	-.056	.001	.809
R sq Total = .243, F(4,41)= 3.28, p =.02					
Verbal Prompt	Age	1	.604	.365	<.001
	Sex	1	.195	.038	.102
	Age X Sex	1	-.275	.004	.601
	Working Memory	1	-.043	.001	.831
R sq Total = .407, F(4,42)= 7.21, p = .0002					
Bizarre Prompt	Age	1	.151	.023	.307
	Sex	1	.179	.032	.225
	Age X Sex	1	.529	.015	.409
	Working Memory	1	-.207	.015	.409
R sq Total = .084, F(4,43)= 0.986, p = .425					
Sad Affect	Age	1	.386	.149	.007
	Sex	1	.030	.001	.826
	Age X Sex	1	.443	.010	.466
	Working Memory	1	-.344	.041	.146
R sq Total = .201, F(4,43)= 2.71, p =.042					
Normal Level	Age	1	.237	.056	.105
	Sex	1	-.128	.016	.379
	Age X Sex	1	.949	.048	.130
	Working Memory	1	-.253	.022	.298
R sq Total = .142, F(4,43) = 1.78, p =.150					

Table 13.
Regressions using Age, Sex, and Digit Span as predictors of Birthday Task competence.

Criterion	Variable	df	β	R sq Change	p
Gesture	Age	1	.249	.062	.111
	Sex	1	.160	.025	.306
	Age X Sex	1	<.001	.000	.999
	Digit Span	1	-.030	.001	.866
R sq Total = .088, F(4,37)= .894, p = .477					
Repeat + Look	Age	1	.447	.120	.002
	Sex	1	-.075	.006	.586
	Age X Sex	1	-.836	.036	.165
	Digit Span	1	.045	.002	.775
R sq Total = .243, F(4,41)= 3.29, p =.020					
Verbal Prompt	Age	1	.604	.365	<.001
	Sex	1	.195	.038	.102
	Age X Sex	1	-.275	.004	.601
	Digit Span	1	-.095	.007	.487
R sq Total = .413, F(4,42)= 7.39, p < .001					
Bizarre Prompt	Age	1	.151	.023	.301
	Sex	1	.179	.032	.225
	Age X Sex	1	.529	.015	.409
	Digit Span	1	.157	.019	.355
R sq Total = .088, F(4,43)= 1.04, p = .400					
Sad Affect	Age	1	.386	.149	.007
	Sex	1	.031	.001	.826
	Age X Sex	1	.443	.010	.466
	Digit Span	1	.034	.001	.834
R sq Total = .161, F(4,43)= 2.07, p =.101					
Normal Level	Age	1	.237	.056	.105
	Sex	1	-.128	.016	.379
	Age X Sex	1	.949	.048	.130
	Digit Span	1	.003	.000	.984
R sq Total = .120, F(4,43) =1.47, p =.229					

Table 14.
Regressions using Age, Sex, and EAS-Emotionality as predictors of Birthday Task competence.

Criterion	Variable	df	β	R sq Change	p
Gesture	Age	1	.249	.062	.111
	Sex	1	.160	.025	.306
	Age X Sex	1	.161	.000	.992
	Emotionality	1	-.099	.008	.570
R sq Total = .095, F(4,37)= .976, p = .432					
Repeat + Look	Age	1	.447	.200	.002
	Sex	1	-.075	.006	.586
	Age X Sex	1	-.836	.036	.165
	Emotionality	1	.132	.014	.378
R sq Total = .256, F(4,41)= 3.52, p =.015					
Verbal Prompt	Age	1	.604	.365	<.001
	Sex	1	.195	.038	.102
	Age X Sex	1	-.275	.004	.601
	Emotionality	1	.039	.001	.768
R sq Total = .408, F(4,42)= 7.22, p = .0002					
Bizarre Prompt	Age	1	.151	.023	.307
	Sex	1	.179	.032	.225
	Age X Sex	1	.529	.015	.409
	Emotionality	1	.259	.055	.108
R sq Total = .124, F(4,43)= 1.52, p = .212					
Sad Affect	Age	1	.386	.149	.007
	Sex	1	.030	.001	.826
	Age X Sex	1	.443	.010	.466
	Emotionality	1	.002	.000	.988
R sq Total = .161, F(4,43)= 2.06, p =.103					
Normal Level	Age	1	.237	.056	.105
	Sex	1	-.128	.016	.379
	Age X Sex	1	.949	.048	.130
	Emotionality	1	.125	.013	.430
R sq Total = .133, F(4,43) =1.65, p =.180					

Table 15.
Regressions using Age, Sex, and EAS-Activity as predictors of Birthday Task competence.

Criterion	Variable	df	β	R sq Change	p
Gesture	Age	1	.249	.062	.111
	Sex	1	.160	.025	.306
	Age X Sex	1	.161	.000	.999
	Activity	1	-.291	.081	.065
R sq Total = .169, F(4,37)= 1.88, p = .135					
Repeat + Look	Age	1	.447	.199	.002
	Sex	1	-.075	.006	.586
	Age X Sex	1	-.836	.036	.165
	Activity	1	-.286	.078	.036
R sq Total = .320, F(4,41)= 4.81, p =.003					
Verbal Prompt	Age	1	.604	.365	<.001
	Sex	1	.195	.038	.102
	Age X Sex	1	-.275	.004	.601
	Activity	1	.170	.028	.159
R sq Total = .434, F(4,42)= 8.05, p = .0001					
Bizarre Prompt	Age	1	.151	.023	.307
	Sex	1	.179	.032	.225
	Age X Sex	1	.529	.015	.409
	Activity	1	-.040	.002	.790
R sq Total = .071, F(4,43)= .819, p = .520					
Sad Affect	Age	1	.386	.149	.007
	Sex	1	.030	.001	.826
	Age X Sex	1	.443	.010	.466
	Activity	1	.150	.022	.288
R sq Total = .183, F(4,43)= 2.40, p =.065					
Normal Level	Age	1	.237	.056	.105
	Sex	1	-.128	.016	.379
	Age X Sex	1	.949	.048	.130
	Activity	1	.250	.061	.081
R sq Total = .181, F(4,43) =2.38, p =.067					

Table 16.
Regressions using Age, Sex, and EAS-Sociability as predictors of Birthday Task competence.

Criterion	Variable	df	β	R sq Change	p
Gesture	Age	1	.249	.063	.111
	Sex	1	.160	.025	.306
	Age X Sex	1	.161	.000	.992
	Sociability	1	-.266	.070	.087
R sq Total = .158, F(4,37)= 1.73, p = .163					
Repeat + Look	Age	1	.447	.199	.002
	Sex	1	-.075	.006	.586
	Age X Sex	1	-.836	.036	.165
	Sociability	1	-.033	.001	.809
R sq Total = .243, F(4,41)= 3.28, p =.020					
Verbal Prompt	Age	1	.604	.365	<.001
	Sex	1	.195	.038	.102
	Age X Sex	1	-.275	.004	.601
	Sociability	1	.183	.033	.125
R sq Total = .439, F(4,42)= 8.22, p = .0001					
Bizarre Prompt	Age	1	.151	.023	.307
	Sex	1	.179	.032	.225
	Age X Sex	1	-.333	.014	.409
	Sociability	1	.516	.001	.799
R sq Total = .071, F(4,43)= .817, p = .521					
Sad Affect	Age	1	.386	.149	.007
	Sex	1	.030	.001	.826
	Age X Sex	1	.443	.010	.466
	Sociability	1	.107	.011	.445
R sq Total = .415, F(4,43)= 2.23, p =.081					
Normal Level	Age	1	.237	.056	.105
	Sex	1	-.128	.016	.379
	Age X Sex	1	.949	.048	.130
	Sociability	1	.003	.000	.981
R sq Total = .120, F(4,43) =1.47, p =.229					

Table 17.
Regressions using Age, Sex, and Number of Friends as predictors of Birthday Task competence.

Criterion	Variable	df	β	R sq Change	p
Gesture	Age	1	.094	.009	.623
	Sex	1	.016	.000	.936
	Age X Sex	1	-.555	.016	.526
	No of Friends	1	-.379	.134	.057
R sq Total = .159, F(4,25)= 1.18, p = .344					
Repeat + Look	Age	1	.388	.151	.026
	Sex	1	-.008	.000	.964
	Age X Sex	1	-1.06	.063	.137
	No of Friends	1	-.040	.002	.817
R sq Total = .216, F(4,28)= 1.93, p =.134					
Verbal Prompt	Age	1	.592	.351	<.001
	Sex	1	.113	.013	.438
	Age X Sex	1	-.082	.000	.895
	No of Friends	1	-.116	.013	.449
R sq Total = .377, F(4,29)= 4.38, p = .007					
Bizarre Prompt	Age	1	.174	.030	.326
	Sex	1	.120	.014	.504
	Age X Sex	1	1.22	.083	.102
	No of Friends	1	.063	.004	.727
R sq Total = .131, F(4,29)= 1.09, p = .379					
Sad Affect	Age	1	.365	.134	.034
	Sex	1	.074	.005	.663
	Age X Sex	1	.904	.045	.206
	No of Friends	1	.240	.055	.160
R sq Total = .239, F(4,29)= 2.28, p =.085					
Normal Level	Age	1	.276	.076	.114
	Sex	1	-.133	.017	.447
	Age X Sex	1	1.32	.097	.068
	No of Friends	1	.021	.000	.902
R sq Total = .191, F(4,29) =1.72, p =.174					

Table 18.
Regressions using Age, Sex, and Family Talk as predictors of Birthday Task competence.

Criterion	Variable	df	β	R sq Change	p
Gesture	Age	1	.249	.062	.111
	Sex	1	.160	.025	.306
	Age X Sex	1	<.001	.000	.999
	Family Talk	1	.142	.019	.378
R sq Total = .107, F(4,37)= 1.11, p = .368					
Repeat + Look	Age	1	.447	.199	.002
	Sex	1	-.075	.006	.586
	Age X Sex	1	-.836	.036	.165
	Family Talk	1	.016	.000	.908
R sq Total = .241, F(4,41)= 3.27, p =.021					
Verbal Prompt	Age	1	.604	.365	<.001
	Sex	1	.195	.038	.102
	Age X Sex	1	-.275	.004	.601
	Family Talk	1	-.048	.002	.695
R sq Total = .409, F(4,42)= 7.25, p = .0002					
Bizarre Prompt	Age	1	.151	.023	.307
	Sex	1	.179	.032	.225
	Age X Sex	1	.529	.015	.409
	Family Talk	1	.263	.066	.077
R sq Total = .135, F(4,43)= 1.68, p = .172					
Sad Affect	Age	1	.386	.149	.007
	Sex	1	.030	.001	.826
	Age X Sex	1	.443	.010	.466
	Family Talk	1	.127	.015	.377
R sq Total = .176, F(4,43)= 2.29, p =.075					
Normal Level	Age	1	.277	.056	.105
	Sex	1	-.128	.016	.379
	Age X Sex	1	.949	.048	.130
	Family Talk	1	.203	.039	.163
R sq Total = .159, F(4,43) = 2.039, p =.106					

However, language acquisition style (whether children were referential or expressive) added significantly to the prediction of the child's overall competence rating at both the VERBAL PROMPT and BIZARRE PROMPT levels. Language acquisition style accounted for 9.7% of the variance at the VERBAL PROMPT level $t(41) = 2.86$, $p = .007$ and 8.3% of the variance at the BIZARRE PROMPT level $t(42) = 3.27$, $p = .049$. Children who were categorized as expressive received higher overall competence ratings for these two levels of response cues than those children whose parents categorized their language acquisition style as referential (see Table 19).

Insert Table 19 about here

Table 19.
Regressions using Age, Sex, and Referential vs. Expressive Language Acquisition as predictors of Birthday Task competence.

Criterion	Variable	df	β	R sq Change	p
Gesture	Age	1	.150	.036	.238
	Sex	1	.485	.048	.169
	Age X Sex	1	.112	.005	.659
	Ref vs Expressive	1	.122	.002	.758
R sq Total = .090, F(4,36)= .894, p = .478					
Repeat + Look	Age	1	.414	.231	<.001
	Sex	1	-.261	.011	.436
	Age X Sex	1	-.409	.056	.077
	Ref vs Expressive	1	-.195	.005	.585
R sq Total = .304, F(4,40)= 4.37, p =.005					
Verbal Prompt	Age	1	.471	.357	<.001
	Sex	1	.441	.038	.106
	Age X Sex	1	-.095	.004	.616
	Ref vs Expressive	1	.759	.097	.007
R sq Total = .497, F(4,41)= 10.11, p < .001					
Bizarre Prompt	Age	1	.112	.036	.205
	Sex	1	.266	.024	.293
	Age X Sex	1	.109	.008	.537
	Ref vs Expressive	1	.522	.083	.049
R sq Total = .151, F(4,42)= 1.87, p = .134					
Sad Affect	Age	1	.266	.139	.010
	Sex	1	.074	.001	.799
	Age X Sex	1	.161	.013	.427
	Ref vs Expressive	1	.430	.039	.162
R sq Total = .193, F(4,42)= 2.50, p =.057					
Normal Level	Age	1	.094	.067	.079
	Sex	1	-.154	.022	.314
	Age X Sex	1	.142	.038	.180
	Ref vs Expressive	1	.085	.006	.180
R sq Total = .132, F(4,42) =1.59, p =.193					

Individual Differences in the Lego Task

Similarly, a series of hierarchical regression analyses in which total Lego Task success served as the criterion were undertaken. For these analyses, a sum (ranging from 0-5) of success across all Lego buildings (MPM-**control** to MPM-4 **behavioural control**) was used as the criterion measure rather than considering each building independently. The method of analysis was identical to that used for the Birthday Task. Age, sex and the relevant interaction term were removed from all analyses before the individual difference measures were entered on the last step. Similar results to those described for the Birthday Task were observed in the Lego Task (see Tables 20 to 27).

Insert Tables 20 to 27 about here

Table 20.
Stepwise Regression using Age, Sex, and PPVT-R as predictors of Lego Task success.

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	PPVT-R	1	.153	.008	.505

R sq Total = .240, F(4,43)= 3.40, p = .017

Table 21.
Stepwise Regression using Age, Sex, and Working Memory as predictors of Lego Task success.

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Working Memory	1	.202	.014	.373

R sq Total = .247, F(4,43)= 3.52, p = .014

Table 22.
Stepwise Regression using Age, Sex, and Digit Span as predictors of Lego Task success.

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Digit Span	1	-.362	.099	.016

R sq Total = .331, F(4,43)= 5.32, p = .001

Table 23.
Stepwise Regression using Age, Sex, and EAS-Emotionality as predictors of Lego Task success.

Criterion	Variable	df	β	$\underline{R}$ sq Change	$\underline{p}$
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Emotionality	1	.114	.011	.440

$\underline{R}$ sq Total = .243, $\underline{F}(4,43)= 3.45$, $\underline{p} = .016$

Table 24.
Stepwise Regression using Age, Sex, and EAS-Activity as predictors of Lego Task success.

Criterion	Variable	df	β	$\underline{R}$ sq Change	$\underline{p}$
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Activity	1	-.141	.019	.296

$\underline{R}$ sq Total = .252, $\underline{F}(4,43)= 3.62$, $\underline{p} = .013$

Table 25.
Stepwise Regression using Age, Sex, and EAS-Sociability as predictors of Lego Task success.

Criterion	Variable	df	β	$\underline{R}$ sq Change	$\underline{p}$
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Sociability	1	.036	.001	.792

$\underline{R}$ sq Total = .234, $\underline{F}(4,43)= 3.28$, $\underline{p} = .020$

Table 26.
Stepwise Regression using Age, Sex, and Number of Friends as predictors of Lego Task success.

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.398	.159	.019
	Sex	1	.155	.024	.350
	Age X Sex	1	.950	.050	.171
	No of Friends	1	-.225	.048	.176

R sq Total = .280, F(4,29)= 2.82, p = .043

Table 27.
Stepwise Regression using Age, Sex, and Family Talk as predictors of Lego Task success.

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Family Talk	1	-.216	.044	.112

R sq Total = .277, F(4,43)= 4.12, p = .007

Table 28.
Stepwise Regression using Age, Sex, and Referential versus Expressive Language Acquisition as predictors of Lego Task success.

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.628	.213	.001
	Sex	1	.498	.016	.345
	Age X Sex	1	.241	.008	.512
	Ref vs Expressive	1	.217	.003	.700

R sq Total = .239, F(4,42)= 3.31, p = .019

Two of the three well-established measures, PPVT-R and Working Memory, again failed to account for any significant variance after age and sex were partialled out of the equations. However, as can be seen in Table 22, Digit Span accounted for an additional 9.9% of the variance $t(43) = -2.52$, $p = .016$. None of the EAS temperament survey subscales, Emotionality, Activity or Sociability added to the prediction of total Lego success. In addition, neither of the two measures of social experience, number of friends nor family talk, added any significant unique variance in predicting children's total Lego success. Moreover, unlike the Birthday Task, language acquisition style did not account for any significant variance in predicting Lego success after age and sex were partialled (see Table 28).

Insert Table 28 about here

<u>"On-Line" Individual Differences in the Birthday Task</u>

On-line measures of social engagement, affect and anxiety were coded before (pre) and after (post) each of the six levels of response cue. Rather than using change scores, which yield an unstable index of pre-post differences according to Cohen and Cohen (1983), all of the prescores were covaried from the post scores and the residuals were saved. The residualized scores then represented an index of the on-line change in the child's social engagement, affect and anxiety throughout the Birthday Task.

The residual scores were entered on the last step of a series of hierarchical regressions undertaken in order to ascertain if the child's on-line change in social engagement, affect or anxiety accounted for a significant portion of the variance in his/her overall competence of response at each level of the Birthday Task. The residualized scores were entered after the variance due to age, sex and the relevant interaction term had already been removed. Age accounted for a significant portion of the variance in overall competence of response at three of the six levels: REPEAT + LOOK, VERBAL PROMPT and SAD AFFECT as can be seen in Tables 29 to 31.

Insert Tables 29 to 31 about here

Table 29.
Regressions using Age, Sex, and On-line change in Social Engagement as predictors of overall competence in the Birthday Task

Criterion	Variable	df	β	R sq Change	p
Gesture	Age	1	.249	.062	.111
	Sex	1	.160	.025	.306
	Age X Sex	1	<.001	.000	.999
	Social Engagement	1	.188	.030	.267
R sq Total = .118, F(4,37)= 1.23, p = .314					
Repeat+Look	Age	1	.447	.120	.002
	Sex	1	-.075	.006	.586
	Age X Sex	1	-.836	.036	.165
	Social Engagement	1	.386	.119	.009
R sq Total = .360, F(4,41)= 5.78, p <.001					
Verbal Prompt	Age	1	.604	.365	<.001
	Sex	1	.195	.038	.102
	Age X Sex	1	-.275	.004	.601
	Social Engagement	1	.247	.052	.052
R sq Total = .458, F(4,42)= 8.87, p < .001					
Bizarre Prompt	Age	1	.150	.023	.307
	Sex	1	.179	.032	.225
	Age X Sex	1	.529	.015	.409
	Social Engagement	1	.636	.378	<.001
R sq Total = .447, F(4,43)= 8.70, p < .0001					
Sad Affect	Age	1	.386	.149	.007
	Sex	1	.030	.001	.826
	Age X Sex	1	.443	.010	.466
	Social Engagement	1	.360	.095	.024
R sq Total = .255, F(4,43)= 3.68, p = .012					
Normal Level	Age	1	.237	.056	.105
	Sex	1	-.128	.016	.379
	Age X Sex	1	.949	.048	.130
	Social Engagement	1	.283	.071	.059
R sq Total = .191, F(4,43) = 2.54, p =.054					

Table 30.
Regressions using Age, Sex, and On-line change in Positive Affect as predictors of overall competence in the Birthday Task.

Criterion	Variable	df	β	R sq Change	p
Gesture	Age	1	.249	.062	.111
	Sex	1	.160	.025	.306
	Age X Sex	1	<.001	.000	.999
	Affect	1	-.062	.003	.724
R sq Total = .091, F(4,37)= .921, p = .462					
Repeat+Look	Age	1	.447	.120	.002
	Sex	1	-.075	.006	.586
	Age X Sex	1	-.836	.036	.165
	Affect	1	.052	.003	.710
R sq Total = .244, F(4,41)= 3.31, p =.008					
Verbal Prompt	Age	1	.604	.365	<.001
	Sex	1	.195	.037	.102
	Age X Sex	1	-.275	.004	.601
	Affect	1	.341	.108	.004
R sq Total = .514, F(4,42)= 11.13, p < .001					
Bizarre Prompt	Age	1	.150	.023	.307
	Sex	1	.179	.032	.225
	Age X Sex	1	.529	.015	.409
	Affect	1	.471	.219	<.001
R sq Total = .288, F(4,43)= 4.35, p = .005					
Sad Affect	Age	1	.386	.149	.007
	Sex	1	.030	.001	.826
	Age X Sex	1	.443	.010	.466
	Affect	1	.060	.003	.705
R sq Total = .163, F(4,43)= 2.10, p = .051					
Normal Level	Age	1	.237	.056	.105
	Sex	1	-.128	.016	.379
	Age X Sex	1	.949	.048	.130
	Affect	1	.274	.070	.061
R sq Total = .190, F(4,43) = 2.52, p =.055					

Table 31.
Regressions using Age, Sex, and On-line change in Anxiety as predictors of overall competence in the Birthday Task.

Criterion	Variable	df	β	R sq Change	p
Gesture	Age	1	.249	.062	.111
	Sex	1	.160	.025	.306
	Age X Sex	1	<.001	.000	.999
	Anxiety	1	-.035	.001	.830
R sq Total = .089, F(4,37)= .899, p = .475					
Repeat+Look	Age	1	.447	.120	.002
	Sex	1	-.075	.006	.586
	Age X Sex	1	-.836	.036	.165
	Anxiety	1	-.034	.001	.807
R sq Total = .243, F(4,41)= 3.28, p =.02					
Verbal Prompt	Age	1	.604	.365	<.001
	Sex	1	.195	.038	.601
	Age X Sex	1	-.275	.004	.601
	Anxiety	1	-.212	.041	.085
R sq Total = .447, F(4,42)= 8.49, p < .001					
Bizarre Prompt	Age	1	.150	.023	.307
	Sex	1	.179	.032	.225
	Age X Sex	1	.529	.015	.409
	Anxiety	1	-.098	.010	.509
R sq Total = .079, F(4,43)= .919, p = .462					
Sad Affect	Age	1	.386	.149	.007
	Sex	1	.030	.001	.826
	Age X Sex	1	.443	.010	.466
	Anxiety	1	.058	.003	.685
R sq Total = .164, F(4,43)= 2.11, p = .097					
Normal Level	Age	1	.237	.056	.105
	Sex	1	-.128	.016	.379
	Age X Sex	1	.949	.048	.130
	Anxiety	1	.081	.006	.576
R sq Total = .126, F(4,43) = 1.56, p =.203					

As can be seen in Table 29, on-line changes in the child's social engagement were predictive of the child's overall competence rating at four of the six levels of the Birthday Task. Change in social engagement at the REPEAT + LOOK level accounted for 11.9% of the variance in the child's overall competence rating at this level of the Birthday Task, $t(41)= 2.761$ $p = .009$. At the VERBAL PROMPT level, change in social engagement accounted for an additional 5.2% of the variance $t(42)= 2.00$, $p =.05$. At the BIZARRE PROMPT level 38% of the variance was accounted for $t(43)= 5.42$, $p <.0001$. Finally, on-line change in social engagement at the SAD AFFECT level accounted for 9.5% of the variance in children's overall competence rating at this level of the Birthday Task $t(43)= 2.34$, $p =.024$. In each instance when on-line change in social engagement accounted for a significant portion of variance over and above that which could be accounted for by age and sex, it was the case that those children whose social engagement scores increased had higher overall competence ratings.

Similarly, the child's on-line change in positive affect at the VERBAL PROMPT ($t(42)= 3.06$, $p = .004$) and BIZARRE PROMPT ($t(43)= 3.63$, $p < .001$) levels accounted for a significant amount of the variance (10.8% and 21.9% respectively) in predicting overall competence of response at these two levels of the Birthday Task (see Table 30). Again, it was the case that those children whose positive affect ratings increased had higher overall competence ratings at the VERBAL PROMPT and BIZARRE PROMPT levels.

None of the overall competence ratings at any of the levels of the Birthday Task were predicted by on-line changes on the anxiety dimension (see Table 31).

"On-Line" Individual Differences in the Lego Task

Similar to the Birthday Task, on-line individual differences were also coded for the Lego Task. Children were again rated on the dimensions of social engagement, affect and anxiety for each of the five test trial buildings. However, children were also rated on the dimension of task engagement. For analysis, all of the pre scores were covaried from the post scores and the residuals were saved. The residualized scores then represented an index of the on-line change in the child's task engagement, social engagement, positive affect and anxiety throughout the Lego Task. The residual scores were then entered on the last step of a series of hierarchical regressions undertaken in order to ascertain which of the on-line dimensions predicted the child's Lego performance.

Only on-line change in task engagement for MPM-4 **(behavioural control)** accounted for any significant amount of the variance (6.4%) in predicting Lego Task performance $t(43) = -1.99$, $p = .05$ (see Table 48). This indicated that those children whose task engagement ratings decreased were more successful overall in the Lego Task. None of the other residual measures (social engagement, affect or anxiety) accounted for any significant variance in predicting total Lego Task performance (see Tables 32 to 51).

Insert Tables 32 to 51 about here

Table 32.
Stepwise Regression using Age, Sex, and Task Engagement during Lego Task MPM-control as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Task Engagement	1	.032	.001	.817

R sq Total = .233, $F(4,43) = 3.27$, $p = .020$

Table 33.
Stepwise Regression using Age, Sex, and Social Engagement during Lego Task MPM-control as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Social Engagement	1	-.139	.018	.319

R sq Total = .250, $F(4,43) = 3.59$, $p = .013$

Table 34.
Stepwise Regression using Age, Sex, and Positive Affect during the Lego Task MPM-control as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Affect	1	-.225	.048	.099

R sq Total = .280, $F(4,43) = 4.18$, $p = .006$

Table 35.
Stepwise Regression using Age, Sex and Anxiety during the Lego Task MPM-control as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Anxiety	1	.142	.018	.310

R sq Total = .251, $F(4,43)= 3.60$, $p = .013$

Table 36.
Stepwise Regression using Age, Sex, and Task Engagement during Lego Task MPM-1 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Task Engagement	1	-.202	.037	.149

R sq Total = .269, $F(4,43)= 3.96$, $p = .008$

Table 37.
Stepwise Regression using Age, Sex, and Social Engagement during the Lego Task MPM-1 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Social Engagement	1	.122	.015	.365

R sq Total = .247, $F(4,43)= 3.53$, $p = .014$

Table 38.
Stepwise Regression using Age, Sex, and Positive Affect during the Lego Task MPM-1 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Affect	1	.127	.015	.358

R sq Total = .248, $F(4,43)= 4.44$, $p = .008$

Table 39.
Stepwise Regression using Age, Sex, and Anxiety during the Lego Task MPM-1 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Anxiety	1	.049	.002	.720

R sq Total = .235, $F(4,43)= 3.30$, $p = .019$

Table 40.
Stepwise Regression using Age, Sex, and Task Engagement during Lego Task MPM-2 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Task Engagement	1	-.073	.005	.601

R sq Total = .237, $F(4,43)= 3.35$, $p = .018$

Table 41.
Stepwise Regression using Age, Sex, and Social Engagement during the Lego Task MPM-2 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Social Engagement	1	.057	.003	.672

R sq Total = .236, F(4,43)= 3.31, p = .019

Table 42.
Stepwise Regression using Age, Sex, and Positive Affect during the Lego Task MPM-2 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Affect	1	.044	.002	.749

R sq Total = .234, F(4,43)= 3.29, p = .019

Table 43.
Stepwise Regression using Age, Sex, and Anxiety during the Lego Task MPM-2 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Anxiety	1	-.121	.014	.383

R sq Total = .246, F(4,43)= 3.51, p = .015

Table 44.
Stepwise Regression using Age, Sex, and Task Engagement during Lego Task MPM-3 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Task Engagement	1	-.167	.026	.229

R sq Total = .258, F (4,43)= 3.74, p = .011

Table 45.
Stepwise Regression using Age, Sex, and Social Engagement during the Lego Task MPM-3 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Social Engagement	1	.134	.017	.318

R sq Total = .250, F(4,43)= 3.59 p = .013

Table 46.
Stepwise Regression using Age, Sex, and Positive Affect during the Lego Task MPM-3 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Affect	1	-.120	.014	.377

R sq Total = .246, F(4,43)= 3.51, p = .014

Table 47.
Stepwise Regression using Age, Sex, and Anxiety during the Lego Task MPM-3 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Anxiety	1	-.214	.043	.116

R sq Total = .276, F(4,43)= 4.09, p = .007

Table 48.
Stepwise Regression using Age, Sex, and Task Engagement during Lego Task MPM-4 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Task Engagement	1	-.260	.064	.054

R sq Total = .297, F(4,43)= 4.54, p = .004

Table 49.
Stepwise Regression using Age, Sex, and Social Engagement during the Lego Task MPM-4 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Social Engagement	1	.107	.011	.432

R sq Total = .244, F(4,43)= 3.46, p = .016

Table 50.
Stepwise Regression using Age, Sex, and Positive Affect during the Lego Task MPM-4 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Affect	1	-.082	.006	.550

R sq Total = .232, F(4,43)= .3.37, p = .017

Table 51.
Stepwise Regression using Age, Sex, and Anxiety during the Lego Task MPM-4 as predictors of Total Lego success

Criterion	Variable	df	β	R sq Change	p
Total Lego	Age	1	.450	.202	.001
	Sex	1	.140	.019	.294
	Age X Sex	1	.448	.011	.440
	Anxiety	1	-.130	.016	.339

R sq Total = .249, F(4,43)= 3.56, p = .014

Discussion

The purpose of this study was to assess the development of monitoring skills in children. To this end, a four component *Monitoring Process Model* (MPM) was developed and tested in order to ascertain at which component process of the MPM age differences would emerge. The four components of the MPM were (1) **assessment;** (2) **evaluation;** (3) **planning;** and (4) **behavioural control**. The MPM was assessed directly using a social-cognitive Lego Task that was adapted for this study from a comprehension monitoring paradigm (Flavell et al., 1981). One of the primary goals of this study was to use the MPM in order to determine at which "stage" of processing children would most likely have difficulty monitoring themselves in a social-cognitive task.

For example, would it be the case that younger children would have the capability to detect (**assess**) problematic communications though not be able to act on their appraisal (**behavioural control**)? Or, would it be the case that young children simply did not even detect (**assess**) problematic utterances and so did not enact the later components of the MPM (e.g., **evaluation, planning** and/or **behavioural control**) because they saw no need to do so?

Another aim of this study was to assess similar processing components to those investigated in the MPM Lego Task in a more naturalistic observation. With this in mind, the Birthday Task was developed. Together the use of the Lego Task (a social cognitive task) and the Birthday Task (a more naturalistic social interaction) allowed for the appraisal of cross-domain continuities and discontinuities in monitoring behaviours. These two tasks also allowed for the investigation of the possibility of a thought-behaviour discrepancy with respect to monitoring skills in children. In this vein, it was expected that younger children who were able to be successful in the social cognitive task might not perform as competently in the Birthday Task due to the increased processing demands of this more naturalistic task.

Age Differences in MPM Lego Performance

The first hypothesis was that there would be developmental differences observed at each of the four components of the MPM (**assessment, evaluation, planning** and **behavioural control**) such that older children would outperform younger children at each component. This hypothesis was partially supported. More older children than younger children were successful in the Lego Task overall. However, significant age differences were not observed for each component of the MPM as expected. Rather, significant age differences emerged for the later component steps of the MPM (MPM-2 **evaluation**, MPM-3 **planning** and MPM-4 **behavioural control**).

This pattern of results was not anticipated and is particularly interesting given that for the first Lego building (MPM control), in which the children received no feedback from the C, no significant age difference was observed. This suggests that without the intervention of the C, younger children (N= 7) monitored about as well as older children (N= 13).

Similarly, at MPM-1 **(assessment)** when children were given the relatively subtle feedback "that's a problem" there was no significant age difference. In this instance, performance for both groups of children dropped compared to baseline (from N=7 to N=4 at MPM-1 for younger children and from N=13 to N=10 at MPM-1 for older children). It would seem then that the first interjection of feedback from the confederate was somewhat disruptive in terms of task performance for both age groups.

This may have occurred because the task environment itself became confusing by virtue of the fact that the children were receiving instructions from one person whereas the feedback was provided by a second person who (until this point) had been working quietly. Indeed, many of the children looked back and forth from the E to the C as if confused about who they should listen to. For some children this confusion may have been detrimental to their task performance.

While significant age differences emerged at MPM-2 (**evaluation**), the number of older children who were successful did not return to the baseline level until MPM-3 (**planning**). Older children outperformed the younger children at MPM-2 (**evaluation**), MPM-3 (**planning**) and MPM-4 (**behavioural control**). These age differences are not surprising given that these MPM components rely on skills that are metacognitive in nature. Older children were expected to be more adept at these skills than younger children. Moreover, because the buildings were given in a fixed order whereby lower level prompts were repeated at each subsequent level (along with additional information), there may have been a learning component to the Lego Task. This would also favour the older children as seven and eight year old children learn faster than four and five year old children.

<u>A Social Developmental Explanation</u>

Vygotsky (1978) used a concept called the *Zone of Proximal Development* (ZPD) in order to refer to the social nature of cognitive development. The ZPD has both a lower and an upper limit. The lower limit of the ZPD represents the level of problem solving attained by the child when working alone. The upper limit of the ZPD represents the maximum additional level of problem solving skill the child can be expected to demonstrate with the assistance of a skilled person. According to Vygotsky, verbal instructions, or some other form of help, from a skilled person (e.g., an adult) provide *scaffolding* which allows children to problem solve at a level they could not otherwise achieve independently. Children are then able to organize this information in their existing mental structures so that they can eventually perform the task on their own.

It seems then, in terms of MPM Lego Task performance, that the older children were more likely than the younger children to be assisted or scaffolded to an extent that allowed them to achieve success. By MPM-4 (**behavioural control**) 88% of the older children were successful with the Lego building compared with only 52% for the MPM control component (a 36% increase).

On the other hand, younger children were not able to make use of the information as provided by the C in order to achieve success in the Lego Task. Thus the task may have been beyond the upper limit of the younger children's ZPD. In other words, the Lego Task may have been too difficult for the young children to master, even with the assistance of an adult providing verbal feedback. This may serve to explain why only 7 of 24 (29%) younger children were successful when receiving no feedback (MPM-control) with no increase in the number of successful children (7 of 24, or 29%) when receiving the most assistance (MPM-4 **behavioural control**).

Indeed, the significant age differences observed at these components of the MPM arose due to the increasing number of older children, relative to younger children, who were successful (see Figure 1, p.44). This may have been due to the older children's ability to incorporate the C's feedback in order to act on the information as it became more explicit. In addition, the older children may have found it easier to recover from the initial disruption of the C's interjection. The latter explanation seems more likely given that the number of younger children who were successful did not return to the baseline level until MPM-4 **(behavioural control)** suggesting a greater disruptive influence on the younger children compared to the older children.

This particular pattern of results raises some interesting questions with respect to developmental differences in monitoring in a social cognitive context. In order for children to be successful in the Lego Task they needed to recognize that the feedback being offered by the C was useful for the task they were doing. Further, the child then needed to act on the information he/she received to achieve the highest competence ratings and maximize his/her potential for success. If, however, the child did not construe the C's interruptions as providing useful information, then the feedback offered by the C only served a disruptive purpose that may actually have hindered rather than helped the child.

In this vein, it seems that although the intention of the C's prompts was to make the task easier and increase the likelihood of success, this was not the case for the younger children. The information provided by the C was not particularly helpful for the younger children as no more younger children were successful in the later components of the MPM than in the baseline condition. In fact, there were three younger children who were successful in the baseline condition and then not again for the remainder of the Lego Task suggesting that for these children the task either became more difficult, and/or they were too disrupted by the C to "recover".

In either case, a conclusion to be drawn from this finding is that simply providing feedback or strategies for younger children (aged four to six years) does not mean that the child will then use the feedback or implement a strategy to his/her advantage. In other words the young children seemed to lack the metacognitive sophistication which would have allowed them to determine that the information offered by the C could be applied to the task at hand. This explanation is consistent with the research of Pressley and Ghatala (1990). These researchers found that in order for children to adjust or modify their behaviour based on feedback, metacognitive awareness of the benefit of the strategies was required.

Task Difficulty as a Function of Age

The fact that there were three younger children who were successful in the MPM Lego Task before any feedback was offered by the C and then not again may indicate that the nature of the task differed for older and younger children once the C intervened. Perhaps the Lego Task became more difficult for the younger children compared to the older children because of the confusion created by receiving instructions from two experimenters instead of one. This may have made the MPM Lego Task a demanding dual task for the young children who were both trying to build the buildings while simultaneously trying to determine which one of the experimenters to listen to. In other words, the processing demands of the situation became too great.

Additionally, because the children were not explicitly told to listen to the C, the Lego Task may have become less structured rendering it too confusing for the younger children to be helped than older children. Indeed, the majority (70% or more) of younger children were not successful in the Lego Task at any of the MPM component steps. Moreover, as Lego success was based on the child's competence of responding to both an ambiguous and an impossible instruction, it is relevant to consider how well children respond to problematic utterances in general.

<u>Children's Responses to Ambiguities</u>

Young children may be used to dealing with ambiguities and miscommunications in their everyday lives in a manner that differs from older children. It may not be wholly competent for young children to question each utterance that they do not understand, as they would be continually stopping to ask questions. Moreover, the gist of an ambiguous statement is often implied either explicitly or implicitly, leading young children to use their knowledge about the world in order to make a best guess about the meaning of a message (Robinson & Whittaker, 1985)

Many researchers have found that, as listeners, young children do not monitor their level of comprehension very well (e.g., Ackerman,1981; Flavell et al., 1981; Robinson & Robinson, 1983). Ackerman (1981) found that children between the ages of five and six were biased to perform a referential communication task (by carrying out an ambiguous instruction) rather than evaluating the utterance itself unless explicitly instructed to do so. He proposed that the context of referential communication tasks is such that young children will proceed with carrying out an instruction they may not understand in order to complete the task rather than attending to the adequacy of the instructions in order to complete a task well. Ackerman (1981) observed that older children (between 7 and 8 years) were much more likely to spontaneously attend to the adequacy of the message before acting on the instruction as given.

Such a performance bias may well have been a factor in the present study as young children's lower mean competence ratings to the ambiguous instructions indicated that (on average) younger children only exhibited a fleeting (approximately two seconds) hesitation before placing a block. This suggests that, although the children were instructed to make their building look *exactly* like the one that the E had made earlier in the day, they may not have comprehended that in order to achieve this goal they needed to receive clear, unambiguous directions (see Robinson & Robinson, 1978). Of course, this may also be an indication that there were different goal priorities to complete the task rather than to do it accurately for younger and older children.

<u>MPM Lego Task as a cross-domain predictor of Birthday Task Performance</u>

The second hypothesis was that success at MPM-4 (**behavioural control**) would be the best predictor (in terms of MPM components) of response competencies in the naturalistic Birthday Task. In this vein, analyses were undertaken in order to ascertain whether or not successful performance in each component of the MPM Lego Task would predict cross-domain competence in a more naturalistic social interchange (the Birthday Task). Indeed, success in the two latter components of the MPM (**planning** and **behavioural control**) was related to overall competence ratings in the Birthday Task.

While MPM-4 was a better predictor than most of the earlier MPM components (**assessment** and **evaluation**), MPM-3 (**planning**) was the best predictor (in terms of a larger $\underline{F}$ value and lower $\underline{p}$ value). An argument can be made, however, that MPM-3 (**planning**) and MPM-4 (**behavioural control**) were both better predictors than the other components in terms of predicting Birthday Task performance.

Cross-domain predictions were not uniform, however, as some levels of the Birthday Task were predicted by Lego Task success at MPM-3 (**planning**) and MPM-4 (**behavioural control**) while other levels were not. Specifically, success with the Lego buildings at MPM-3 (**planning**) and MPM-4 (**behavioural control**) were predictive of overall response competence ratings for three of the six levels of the Birthday Task: REPEAT + LOOK, VERBAL PROMPT and SAD AFFECT. Similarly, the interaction between MPM success and level of Birthday Task was significant for MPM-3 (**planning**) and MPM-4 (**behavioural control**) (see figures 2 and 3, pp. 59-60).

Taken together these results suggest that those children who were able to come up with a plan and implement that plan in the Lego Task were more likely to respond competently in the naturalistic task. This result was not a function of age or gender as these two variables served as covariates in the analyses. This finding lends support to the notion that with increasing cognitive complexity (i.e., being able to devise a plan and then implement that plan) there may be some increased competency observed across task domains in terms of increased social competency (see Keating & Clark, 1980 for a description of cross-domain competencies in adolescents).

However, this cross-domain continuity was only observed for particular types of verbal feedback. There was no cross-domain prediction for the GESTURE, BIZARRE

PROMPT or NORMAL LEVELs of response cue. This suggests that the nature of verbal feedback may have a profound effect in terms of the listener's ability to respond competently to it.

Success at MPM-4 (Behavioural control)

It was expected that even those younger children who were successful at MPM-4 **(behavioural control)** would be less competent in the Birthday Task compared to older children due to the increased processing demands of the naturalistic task. Contrary to prediction, however, younger and older children who were successful at MPM-4 did not differ significantly with respect to their performance on the Birthday Task. Although there were different overall competence ratings across the levels of the Birthday Task, they were not a function of age. This suggests that there was cross-domain continuity in terms of behavioural control. Children who were successful with the Lego Task were more likely to be rated as competent in the Naturalistic Birthday Task regardless of age.

This finding is somewhat puzzling in light of the research done on children's increasing working memory capacity as a function of age (e.g., Gathercole & Baddeley, 1993; Siegel & Ryan, 1989). Indeed, there is much support for the notion that complex cognitive capabilities arise, in part, due to the development of working memory capacity (e.g., Case, 1978, 1985). It would seem then that the tasks employed in the current study tapped skills that were complex although not directly related to capacity. While this finding suggests that social experience and/or other individual difference variables may have influenced task performance, the discussion below will suggest that this was not the case in the current study.

Individual Differences and Cross-Domain Performance

Individual differences in social experience (language acquisition style, family talk and number of friends), cognitive capacity (Working Memory Task and Digit Span) general verbal ability (PPVT-R), and temperament (EAS survey) were expected to enhance the prediction of competence ratings for both the Lego and Birthday Tasks. However, there were only two variables which added significant variance in predicting competence. They were language acquisition style for the Birthday Task and Digit Span for the Lego Task.

Children's language acquisition style as rated by their parent(s) was the only individual difference variable to add significant variance to the prediction of overall competence ratings in the Birthday Task. Children who were categorized as having an expressive language acquisition style had higher overall competence ratings at both the VERBAL PROMPT and BIZARRE PROMPT levels of the Birthday Task accounting for 9.7 and 8.3% of the variance respectively.

This result may provide some support for Snyder's (1987) notion that expressive children are more contextually aware than their referential counterparts exhibiting behaviours consistent with his conception of high self-monitors. However, as there were only significant group differences observed at two of the six levels of the Birthday Task, this outcome must be considered with caution. Moreover, there was no difference in performance between referential and expressive children in the Lego Task as expected.

In the Lego Task, Digit Span accounted for an additional 9.9% of the variance in total Lego performance. However, the direction of the effect was opposite to what would have been expected: children with higher Digit Span scores had lower total Lego success scores. Indeed, both these results (i.e., language acquisition style in the Birthday Task and Digit Span in the Lego Task) may well have been due to Type I error considering the number of regressions that were performed in order for two measures to yield significant results in terms of individual differences.

On-Line ratings of individual differences in terms of task engagement, social engagement, positive affect, and anxiety also failed to enhance the prediction of task performance in the Lego Task and the Birthday Task. This might have been a result of relatively subtle on-line changes for these measures which could not be captured by the use of a 5-point rating scale. For example, a child who received a prescore rating of four on the anxiety dimension could only show an increase in anxiety of one (+1) . Then, because of the use of residual scores (a prescore covaried from a postscore), the magnitude of such a change becomes quite small (a fraction). In addition, there were many children whose scores did not change (i.e., no difference between prescore and postscore). However, if the rating scale used was more sensitive (e.g., a 7-point or even a 9-point scale) the number and magnitude of the changes for the on-line dimensions might have added significant variance to the prediction of task performance.

<u>How do these findings relate to Monitoring in general and the MPM in particular?</u>

When predicting behaviour in the naturalistic Birthday Task it is interesting to note that the levels which could be predicted either by Lego Task success (in the MANOVAs) or age (in the regression equations) overlapped. In other words, the response cue levels REPEAT + LOOK, VERBAL PROMPT and SAD AFFECT were the levels that were predicted well by Lego Task success. It was at these same three levels for which age was a significant predictor in the regression equations. The other three levels (GESTURE, BIZARRE PROMPT, and NORMAL LEVEL) were not predicted by any of the measures other than the language acquisition style, which added variance to the prediction of the overall competence rating at the BIZARRE PROMPT level.

Taken together, these findings suggest that the particular type of feedback offered by a listener may tap different communication skills affecting the adjustments that a young speaker makes. Telling a child that his/her message is not understood, for example, is a salient cue that should be noticed and corrected by children who are monitoring the conversation. However, a puzzled look without any verbalization may be a cue that is too subtle for children to detect even at eight years of age. Given the relatively low mean level of competence in responding to the GESTURE (1.90 for younger vs. 2.45 for older children), this particular response cue was not noticed or noticed only fleetingly by the majority of the children. Moreover, some of the levels of the Birthday Task may well fit the proposed MPM better than other levels. When children were told that there was a problem with their utterances, they were able to incorporate this information and act on it by offering clarification for the listener.

In terms of the Lego Task, it would seem that there is a developmental progression in the component skills of the MPM such that older children were more likely to be able to achieve success in the highest component **(behavioural control)** than the young children. This suggests a developmental difference in understanding or knowing that there is a problem vs. being able to implement a plan of action to correct for that problem. This is consistent with findings in the vast literature on *executive functions* (e.g., Dennis, 1991).

Executive functions are complex psychological functions including attention, self-awareness, planfulness, sensitivity to social cues and organization (Segalowitz, 1995). Executive ability also involves goal-setting and controlling behaviour with respect to its intended result (Dennis, 1991). Failure to exhibit these executive skills in appropriate social contexts reflects developmental immaturity. Interestingly, however, deficits in these types of skills are also seen in patients who have sustained damage to the frontal regions of the cortex (Grattan & Eslinger, 1992; Stuss & Benson, 1987) rendering them, among other things, less able to monitor in social situations.

This has recently led developmental neuropsychologists to propose that there are sound theoretical reasons to consider processes of brain maturation in theories of social cognitive development (Segalowitz & Rose-Krasnor, 1992). For example, many social cognitive skills such as self-monitoring, metacognition and planning, which are needed for competent social behaviour, depend on frontally based neural processes (Segalowitz & Rose-Krasnor, 1992). The age group differences observed in the MPM Lego Task in the present study are consistent with what are presumably underlying maturational differences in brain development.

Evaluation of the MPM

The MPM was able to predict cross-domain continuities (from the Lego Task to the Birthday Task) for some behaviours. It would seem, however, that the nature of the feedback had much to do with the child's response. There were no consistent results observed across domains at the GESTURE level when there was no verbalization to draw the child's attention to a communication inadequacy. Moreover, the nature of an utterance also had an impact. Explicit requests for clarification or simply repeating what was said in a questioning tone was a salient enough cue for the older children to respond to competently. However, these utterances may have either been too subtle for the younger children, or the younger children could not decide what to do about the miscommunications at these levels.

However, age differences in response competence did not exist for utterances that were bizarre. Highly unusual verbalizations may be particularly easy to evaluate in terms of their communicative effectiveness. The bizarre prompts provided obvious cues that there had either been some miscommunication or that the C was looking for a response from the child.

Similarly, in the Lego Task there was no age difference in competence ratings to the impossible instructions. These instructions consisted of nonwords (e.g., tramalgoff horzingloffen, dilligaff) which may have sounded so strange to the children that they attracted particular attention.

Thus, the type of verbalization made by a speaker may alter how much attention the child listener gives to the message. Subtle cues of miscommunication were not noticed or corrected by the children in the current study. As the cues became less subtle, it became more obvious that there was a problem with an utterance (e.g., bizarre and impossible verbalizations). Even the young children were able to direct their attention to such an utterance and respond more competently than when the utterance was more subtle.

Revision of the MPM

There needs to be more baseline testing of what a child has monitored independent of what he/she is told in order to control for the disruptive influence of receiving feedback from a second adult. Despite this disruptive influence, however, there does seem to be a gap between the younger children's ability to detect a problem (**assess**) and their ability to come up with a plan and implement that plan.

In general, it seems that there needs to be more steps added between the evaluation (MPM-2), planning (MPM-3) and behavioural control (MPM-4) levels of the *Monitoring Process Model.* Specifically, **evaluation** needs to be considered in two parts (i) evaluation of what the nature of the problem is and (ii) evaluation of whether the problem interferes with the situational goal set by the child.

It may have been the case, for example, that a child was aware that there was more than one white block but that his/her primary task goal was to finish the Lego Task rather than build a building that looked *exactly* like the one that the E had made earlier. These differing task goals may therefore have led the child to be successful evaluators of the nature of the problem apart from the desired goal of building his/her building according to the instructions to make an exact replica.

By splitting the evaluation component into two components, the planning component also changes in that the plan a child devises depends upon the evaluation of the problem. The same applies for the last component of the MPM. Adding these steps allows us to ascertain more specifically at what point younger children are no longer able to perform the task as well as older children.

As the age differences in the Lego Task emerged at MPM-2 (**evaluation**), it is important that there is some way of determining more specifically the task goals of the children. If young children simply wanted to build the buildings and were biased to perform the task, despite the ambiguous instructions, then the problematic instructions would not necessarily be evaluated as such. On the other hand, older children presumably evaluated the problematic utterances as interfering with the task goal of building structures which looked exactly like ones that the E made earlier in the day.

Perhaps there could be a prompt added where the C says to the child something like "That's a problem. You have more than one white block" and then asks the child "What are you supposed to do again?" in order to ascertain if the child has kept the task instructions (hence task goals) in mind.

Suggestions for Future Investigations

There are many variables to explore in terms of social experience. Several parents mentioned that their child was not permitted to question authority figures. Given this style of parenting, it is not surprising that some children did not question the adult although they looked puzzled with respect to the instructions. Further studies need to include a parenting style measure in order to tap authoritarianism as children raised in this type of environment may be less likely to question any adult.

Another way of ensuring that children would be more likely to listen to the feedback offered by a C would be if there were two tables set up in the room with the same array of blocks to choose from and the second child (a confederate) is seemingly building the same Lego buildings based on the instructions offered by the E. The second child would be positioned either behind a screen or with his/her back to the target child so that the target child could not see where the child confederate was placing his/her blocks.

In this manner, when one of the problematic instructions is given and the child C says "That's a problem" or "That's a problem. I have more than one white block" etc. the performance of the young children might improve dramatically because this second child should be construed as being a source of useful, relevant information as he/she would be doing the same task. The child C could also ask direct questions of the target child "What could I do about that?" or "What are you going to do about that?"

Conclusions and Practical Implications

According to McDevitt and Ford (1987), speech is fundamental to responding to social demands. Thus the development of skills that aid in communicative competence can only serve to assist individuals, particularly in social contexts. As learning often takes place within a social context (e.g., classrooms) it seems crucial that children are able to maximize the component skills necessary to become good communicators. Children need to be able to recognize and to tell their teacher if they have not understood what was said, particularly when learning new material.

Results of this first study of the MPM indicate that MPM-2 (**evaluation**) may be a transition point with respect to developmental differences in monitoring skills. Children who are not able to evaluate communications with respect to situational goals are not likely to request clarification as they are unable to determine the exact nature of the problem. If a child is unable to **evaluate** successfully then the MPM leads us to presume that the he/she would also not be able to devise a **plan** or act on that plan (**behavioural**

control).

Thus, teachers in particular need to be encouraged to model monitoring behaviours to the children in their classrooms. Teachers could draw their students' attention to utterances in order to assist children to **evaluate** the utterance itself. In addition, teachers could ask for clarification when a child has said something ambiguous. These types of experiences should serve to enhance children's ability to monitor communications leading to richer learning and richer social interactions.

In summary, this study assessed the development of monitoring skills in children using a four component *Monitoring Process Model* (MPM). Each of the four components (**assessment**, **evaluation, planning** and **behavioural control**) was appraised independently in a social cognitive Lego Task. Results indicated there were developmental differences in the **evaluation, planning,** and **behavioural control** components. This suggests a developmental gap between the ability to detect a problematic communication and the ability to successfully devise and implement a plan to facilitate communication.

However, the results also lend themselves to cross-domain continuity of behaviour for some aspects of monitoring regardless of age. It appears that children who have the metacognitive capability to devise and implement a plan may be more socially attuned to particular types miscommunications in an unfolding social situation. This individual difference in cross-domain monitoring ability warrants further investigation.

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Appendix A
Parent Questionnaires, Protocols, Test Materials, and Coding Criteria

Demographic Information Questionnaire
Family Background Information

In order to be able to compare the responses of the participants in this study we need some information about your household and family. Please answer the following questions to the best of your ability.

PARENTAL INFORMATION:

Your name:____

Home address:____

Telephone number:_______________

1) What is your relationship to the child participating in this study?( )Mother ( )Father
( )Other(please specify)____________

2) How old are you?
( )19-25 ( )26-30 ( )31-35 ( )36-40 ( )41-45 ( )46 or older

3) What is the highest level of education you attained?______________

4) Do you currently work outside of the home? **( )Yes ( )No**

If **YES**, please specify the exact job title below

____

If **NO,** did you ever work outside of the home?
( )Yes ( )No
If **YES**, please specify the exact job title below

____

5) With which ethnic group do you identify? (please check one)
Caucasian/Canadian ( )
African/Canadian ( )
Hispanic/Canadian ( )
Asian/Canadian ( )
Aboriginal/Canadian ( )
Other(please specify) ( )____________________

Demographic Information Questionnaire (continued)

6) If you have a partner, does he/she identify himself/herself with this same group?
( )Yes ( )No
If **NO**, with which group does your partner identify?__________________

FAMILY SITUATION:

7) What is your current marital status? (please check one)
Married ( )
Divorced ( )
Separated ( )
Remarried ( )
Living with partner ( )
Widowed ( )
Single, never married ( )
Other (please specify)___________

CHILD (PARTICIPANT) INFORMATION:
8) What is your child's first name? ________________
9) What is your child's date of birth?___________

SIBLINGS:
10) Please list each **SIBLING'S** gender and age (in years and months) in the chart below. If you should need more space, please write on the back of the page.

Child	Gender	Age (in years, months)
1	( )M ( )F	
2	( )M ( )F	
3	( )M ( )F	
4	( )M ( )F	

Demographic Information Questionnaire (continued)
PEER RELATIONSHIPS:

11) How many friends does your child have? __________

12) How often does your child see his/her friends?(check one)
every day ( )
several times a week ( )
at least once a week ( )
a couple of times a month ( )
once a month ( )
Less than once a month ( )

13) Does your child have a best friend?
( )Yes ( )No
If **YES**, please answer the next 3 questions about your child and his/her best friend. If **NO**, then please go to question #17.

14) How long have they been friends?______________________

15) How often do they meet? (please check one).
Every day ( )
Several times a week ( )
At least once a week ( )
A couple of times a month ( )
Once a month ( )
Less than once a month ( )

16) Where do they meet? (check as many as apply)

At school ( )
At home ( )
At social events (e.g., sports) ( )

17) Did your child attend daycare? **( )Yes ( )No**
If **YES**:
For how long?________________
Approximately how many hours per week?____________

18) Please feel free to use the back of the page to include any comments you might have.

Family Talk Questionnaire

Please rate the following items from 1 (Never) to 7 (Always) on the scale provided.

1) When my child does something that pleases me, I tell him/her that I am happy.

Never 1 2 3 4 5 6 7 Always

2) When my child does something that makes me sad, I tell him/her that I am sad.

Never 1 2 3 4 5 6 7 Always

3) When my child does something that makes me angry I tell him/her that I am angry.

Never 1 2 3 4 5 6 7 Always

4) When I do something that pleases my child, he/she tells me that he/she is happy.

Never 1 2 3 4 5 6 7 Always

5) When I do something that makes my child sad, he/she tells me that he/she is sad.

Never 1 2 3 4 5 6 7 Always

6) When I do something that makes my child angry, he/she tells me that he/she is angry.

Never 1 2 3 4 5 6 7 Always

7) How often are emotions talked about in your home? (please check one)

Less than once a month ( )
Once a month ( )
A couple of times a month ( )
Once a week ( )
A couple of times per week ( )
Once a day ( )
More than once a day ( )

Family Talk Questionnaire (continued)

8)If **my child** did not understand something **I** said I would ***most likely*** ...(circle your choice)

a)repeat what I had said.
b)rephrase what I said in a different way.
C)ask him/her what it was he/she did not understand.
d)say something like "what I meant was..."
e)tell him/her to listen more carefully.

9)If **I** did not understand something **my child** said he/she would ***most likely*** ...(circle your choice)

a)repeat what he/she had said.
b)rephrase what he/she said in a different way.
C)ask me what it was that I did not understand.
d)say something like "what I meant was..."
e)tell me to listen more carefully.

It is known that there are different patterns of language acquisition. In other words, when children are first learning to speak they do so in a variety of different ways. It is not a matter of one pattern being "better" than another. Each pattern of language acquisition has its strengths.

In order to understand how your child first learned to speak please indicate by circling **1 of the following 2** descriptions which you feel **best fits** your child's pattern of speaking when he/she was first learning to talk.

Which is more like your child?**(CIRCLE ONE)**

1) My child pointed to people and objects and quickly learned to name them.

OR

2) My child learned to imitate adult speech patterns (intonations and expressions) before really understanding the meaning of the words he/she was using. In other words, he/she was very expressive.

THE EAS TEMPERAMENT SURVEY (Buss & Plomin, 1984)

NAME:____________________________

Please rate each of the items on a scale of 1(not characteristic or typical of my child) to 5(very characteristic or typical of my child).

1) My child likes to be with people.	1 2 3 4 5
2) My child usually seems to be in a hurry.	1 2 3 4 5
3) My child is easily frightened.	1 2 3 4 5
4) My child frequently gets distressed.	1 2 3 4 5
5) When displeased, my child lets people know it right away.	1 2 3 4 5
6) My child is something of a loner.	1 2 3 4 5
7) My child likes to keep busy all the time.	1 2 3 4 5
8) My child is hotblooded and quick-tempered.	1 2 3 4 5
9) My child often feels frustrated.	1 2 3 4 5
10)My child's life is fast paced.	1 2 3 4 5
11)Everyday events make my child troubled and fretful.	1 2 3 4 5
12)My child often feels insecure.	1 2 3 4 5
13)There are many things that annoy my child.	1 2 3 4 5
14)When my child gets scared, he\she panics.	1 2 3 4 5
15)My child prefers working with others rather than alone.	1 2 3 4 5
16)My child gets emotionally upset easily.	1 2 3 4 5
17)My child is bursting with energy.	1 2 3 4 5
18)It takes a lot to make my child mad.	1 2 3 4 5
19)My child has fewer fears than most children his\her age.	1 2 3 4 5
20)My child finds people more stimulating than anything else.	1 2 3 4 5

Naturalistic Birthday Task

This will be the first task performed by the children in the playroom so there will be some preliminary "small talk" to make the children feel at ease. These small talk items will be similar, if not identical for all children. They will include preliminary items such as: "This is the playroom".

1) You can sit in this chair and I'll sit over here (demonstrating).

2) You can call me (Name of experimenter)

3) What is your name?

4) How are you today?

5) Isn't it a sunny\nice\cold day? (as appropriate).

6) How old are you?

7) When is your birthday?

The preceding uneventful conversation will take approximately 1-2 minutes for all subjects. The next part of the task will consist of similar questions for all subjects but responses may differ and this will vary the total length of time as well as the number of prompts required by the experimenter (C).

8) Have you ever had a birthday party?
-If the child answers **YES** to #8, then ask:

9) Can you tell me what happened at your last birthday party?
   -If the child answers **NO** to #8, then ask:

10) Have you ever been to a birthday party?

11) Can you tell me what happened at the last birthday party you went to?
    We expect children to describe similar things like "there was a cake, candles, presents, friends, family, games..."
    Prompts such as "What else was there?"/"What else did you do/eat?" "Who else was there?" may be necessary in order to have enough items for the C to respond to.

Birthday Task (continued)

Confederate Responses:

The experimenter's responses will progress from a level of conversationally appropriate to increasing levels of perplexity with what the child is saying. Initially, the C's difficulties will be more subtle, but eventually they will become more explicit, and finally they will be inappropriate (strange or bizarre).

The following are examples of the different levels of responses that will be used by the experimenter:

1) conversationally appropriate responses will include things like: what kind of cake? how many candles?

2)the next level of response cue consists of puzzled looks and/or gestures (wrinkled brows, shrugging shoulders etc.)

3)Repeating what the child said using a questioning intonation: "Your friends came?" "You say you ate cake and ice cream?"

4)Next there will be explicit questions about meaning such as:"I don't understand, you played outside?"/"What do you mean you played games?"

5)The 2 unexpected/bizarre responses will be based upon what the child has said: "It's really great when you get to eat grass on your birthday" "You're right, the best part about birthdays is when nobody comes to the party".

6)Finally the E will display inappropriate (flattened) affect and say "Talking about birthdays always makes me sad". This statement will be made in the same manner to all children and approximately 20 seconds will pass before the E enters the playroom to debrief the child

Protocol for subject debriefing between Birthday Task and Lego Task

E will enter the room after the C has displayed flattened affect for about 20 seconds. The C will then leave the room so that the child and the E are alone.

E will then ask the child a series of questions about the C and debrief the child about why the C felt the way she did.

1) What did you and (name of C) talk about?
2) Some children have told us that (name of C) does not understand them and other children have told me that she does. Did (name of C) understand you?
3) How did you know?
4) Some children have told us that (name of C) says silly things and other children have told us that she does not; Did (name of C) say silly things? If **yes**, what was a silly thing (name of C) said?
5) What did you think of (name of C)?
6) Do you remember how (name of C) said she felt?
7) Why do you think she said that?
8) What did (name of C) say about grass?
9) What did (name of C) say about no one coming to the party?

At this point the C will rejoin E and the child.

E will ask the C if she is having a bad day.

The C will respond:

"You know I've been having a bad day, but I had a glass of water and I am feeling better now"

E will say: "I'm glad you are feeling better now"

The C will then tell E and the child that she has some paperwork to do and will sit in the third chair in a corner of the room.

LEGO TASK INSTRUCTIONS -as read to participants

PRACTICE TRIAL #1

Earlier today I made some Lego buildings. I am going to give you directions so that you can make some buildings that look exactly like the ones I made.

Do you see the blue dot in the middle of this tray? This will be where you put the blocks for your building so that it looks **exactly** like mine. I'll tell you how to do it.

(take the Legos out and place on the table in front of the child).

"These blocks are arranged with the *little* blocks on top of the *big* ones. See, how they are attached so they can't fall off? The little ones are also in the middle of the big ones, see? So, when I tell you to put a block on top of another one I mean like this- so it won't fall off and it's in the middle. Let's try one."

1) Put the big white block in the middle of the tray.

"Good". That block will be the bottom of the building.

2) Put the little blue block on top of the big white one.

"Good".--check to make sure it is secure and in the middle.

3) Now put the little yellow block on top of the little blue one.

"Good".-check to make sure it is secure and in the middle.

1) Do you think your building looks *exactly* like the one I made earlier today?

2) How SURE are you? (give feedback about use of the scale here)

3) How do you know?

Lego INSTRUCTIONS (continued)
PRACTICE TRIAL #2
Experimenter places the large yellow block in the centre of the tray.

1) Put the big green block on the tray beside the yellow one.

"Good".

2) Take the big red one

3) Put the big red one on top of the blocks on the tray.

"Good". (tell child that "on top of" means so that the blocks are stuck together and in the middle)

4) Put the little white block on top of the big red one.

"Good".

5) Put the big blue one next to the little white one.

"Good".

1) Do you think your building looks *exactly* like the one I made earlier today?

2) How SURE are you? (give feedback about use of the scale here)

3) How do you know?

Lego INSTRUCTIONS (continued)
MPM-control

When I built this next building earlier today these blocks made the bottom of it.
(PUT BASE FOR TEST BUILDING 1 ON THE TRAY).

1) Put your big white one on top of the BIG BLUE BLOCK (pointing).

Hand child the small red block
2) Put this one on top of the white one (AMBIGUOUS)

3) Take the "hmmmhmmm" (E clears throat) one off and put it here (pointing) (IMPOSSIBLE)

4) Put your small blue one on top of the yellow block.

5) Put your little green one at the very top of the building.

1) Do you think your building looks *exactly* like the one I made earlier today?

2) How SURE are you?

3) How do you know?

Lego INSTRUCTIONS (continued)
MPM-1 (assessment)

When I built this next building earlier today these blocks made the bottom of it.
(PUT BASE FOR BUILDING ON THE TRAY)

HAND THE CHILD THE SQUARE YELLOW BLOCK AND SAY
1) Put your big blue block on top of the yellow one (only one yellow block on base).

2) Now put your big white one on top of the red one (only one red block on base)

3) Put your green one on top of the blue one (AMBIGUOUS)
C interjects: "THAT'S A PROBLEM"

4) Put the little red one on top of the white one.

5) Put the horzingloffen beside the building. (IMPOSSIBLE)

1) Do you think your building looks *exactly* like the one I made earlier today?

2) How SURE are you?

3) How do you know?

Lego INSTRUCTIONS (continued)
MPM- 2 (evaluation)

When I built this next building earlier today these blocks made the bottom of it.
(PUT BASE FOR BUILDING ON THE TRAY)

When I built this next building earlier today these blocks made the bottom of it.

1) Take the pengalow off the top and put it here (pointing) (IMPOSSIBLE).

Experimenter picks up the largest red block and says....
2) Put this red one on top of the green block.

3) Put your white block on top of the red block (AMBIGUOUS)
C interjects: "THAT'S A PROBLEM, YOU HAVE MORE THAN ONE WHITE BLOCK."

4) Now put the smallest green block on top of the blue block .

Hand child the small green block and say....
5) Put this block at the very top of the building.

1) Do you think your building looks *exactly* like the one I made earlier today?

2) How SURE are you?
3) How do you know?

Lego INSTRUCTIONS (continued)
MPM-3 (planning)

When I built this next building earlier today these blocks made the bottom of it.
(PUT BASE FOR BUILDING ON THE TRAY)

Hand child the small blue block and say....
1) Put this block on top of the green block.

2) Put your small green block on top of this white one (pointing).

3) Now put the tramalgoff on top of the blue one (IMPOSSIBLE)

4) Put your white one on top of the red one (AMBIGUOUS)
"THAT'S A PROBLEM, YOU HAVE MORE THAN ONE WHITE BLOCK, I WONDER WHAT YOU COULD DO ABOUT THAT? (anything else?)

5) Put your little blue one at the very top of the building

1) Do you think your building looks *exactly* like the one I made earlier today?

2) How SURE are you?

3) How do you know?

Lego INSTRUCTIONS (continued)
MPM-4 (behavioural control)

When I built this next building earlier today these blocks made the bottom of it.
(PUT BASE FOR BUILDING ON THE TRAY)

1) Put your big green block on top of the red one..

2) Put your little blue block on top of the white one..

3) Now put the red one on top of the green block (AMBIGUOUS)
C interjects: "THAT'S A PROBLEM, YOU HAVE MORE THAN ONE WHITE BLOCK. WHAT YOU COULD DO ABOUT THAT? I GUESS YOU COULD ASK HER TO REPEAT WHAT SHE SAID OR YOU COULD JUST PICK ONE OF THE TWO, OR YOU COULD ASK HER (EXPERIMENTER NAME) WHICH ONE SHE MEANS.

4)Put the dilligaff on top of the yellow one (IMPOSSIBLE)

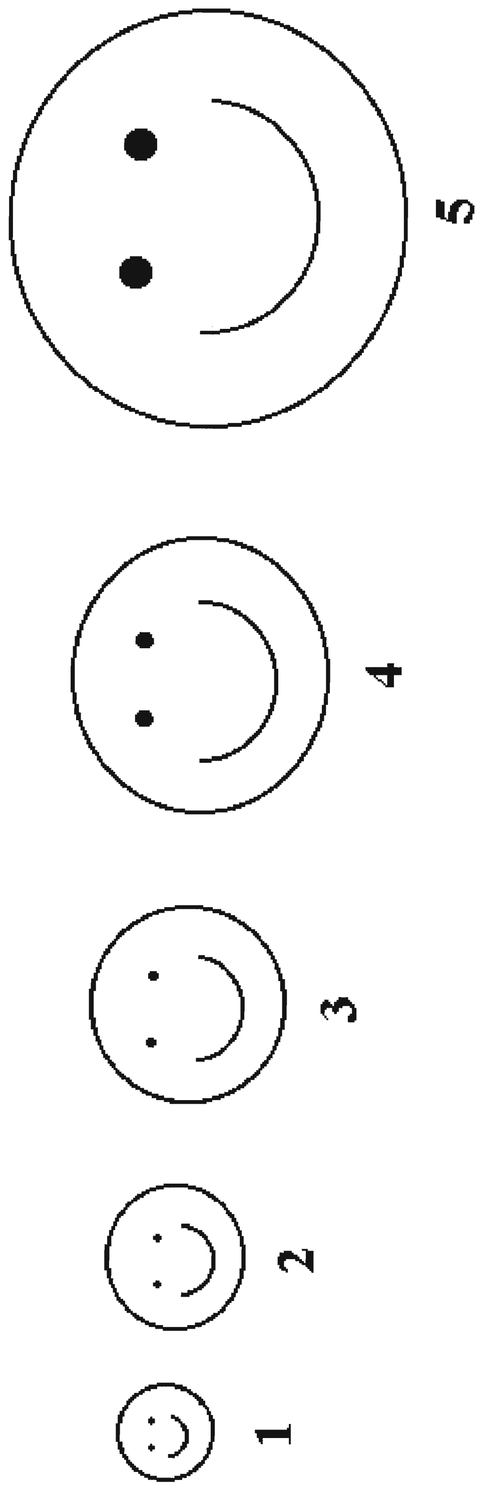
5) Put the little yellow one at the very top of the building

1) Do you think your building looks *exactly* like the one I made earlier today?

2) How SURE are you?

3) How do you know?

Visual Likert Scale



Prompts given by Confederate in Lego Task

MPM-control (Test trial #1) --baseline or control condition
- no prompts

MPM-1 (Test trial #2) ----controls for assessment
-confederate says: **"That's a problem"**

MPM-2 (Test trial #3) ----controls for evaluation
- -confederate says: **"That's a problem. You have more than one white block"**

MPM-3 (Test trial #4) --controls for planning
- -confederate says: **"That's a problem. You have more than one white block. What could you do about that?" Anything else?"**

MPM-4 (Test trial #5) --controls for behavioural control
- -confederate says: **"That's a problem. You have more than one white block. What could you do about that? I guess you could ask her to repeat what she said. Or, you could just pick one of the two red blocks. Or, you could ask her which one she means."**

NOTE:
Confederate interjections are given immediately following the completion of the ambiguous instruction given by the E.
The baseline condition was designed to determine the child's level of monitoring independent of any assistance received. The prompt serve to move children through the various component levels of the MPM.

WORKING MEMORY TASK (from Siegel & Ryan, 1989)

NAME:______________________________ DATE:_________________

INSTRUCTIONS:

I am going to say some sentences and the last word in each sentence will be missing. I want you to tell me what you think the last word should be. Let's try one:

For breakfast the little girl had orange________________.

Good! That's a word that can go at the end.

Now I am going to read two sentences. After each sentenced I want you to tell me the word that should go at the end of the sentence. When I finish both sentences, I want you to tell me the two words that you said should go at the end. Please tell me the words in the order you said them. Let's try it.

When we go swimming we wear a bathing________________.

Cars have to stop at a red ___________.

Good.

(Note: Announce each new level. Stop when all at one level are failed).

2a

1. In a baseball game, the pitcher throws the_________.
2. On my two hands, I have ten_________.

Subject's responses_______________ _______________

2b

1. In the fall, we need to rake_________.
2. When we are sick, we often go to the _________.

Subject's responses:_______________ _______________

2c

1. An elephant is big, a mouse is_________.
2. A saw is used to cut_________.

Subject's responses:_______________ _______________

WORKING MEMORY TASK (continued)

3a

1. Running is fast, walking is__________.
2. At the library, people read__________.
3. An apple is red, a banana is__________.

Subject's responses:____________ ____________ __________

3b

1. The sun shines during the day, the moon at__________.
2. In the Spring, the farmer plows the__________.
3. The young child had blond hair and blue__________.

Subject's responses:____________ ____________ __________

3c

1. In summer, it is very__________.
2. People go to see monkeys in a__________.
3. With dinner we sometimes eat bread and__________.

Subject's responses:____________ ____________ __________

4a

1. Please pass the salt and__________.
2. When our hands are cold, we wear__________.
3. On my way to school, I mailed a__________.
4. After swimming, I was soaking__________.

S's responses:_________ __________ _________ _________

4b

1. Snow is white, coal is__________.
2. After school, the children walked__________.
3. A bird flies, a fish__________.
4. In the barn, the farmer milked the__________.

S's responses:_________ __________ _________ _________

WORKING MEMORY (continued)

4c

1. In the autumn, the leaves fall off the _________.
2. We eat soup with a_________.
3. On hot days, I go to the pool to_________.
4. We brush and comb our _________.

S's responses:________ _________ ________ ________

5a

1. For the party, the girl bought a pretty pink_________.
2. Cotton is soft and rocks are_________.
3. Once a week the maid washes the kitchen_________.
4. In the winter we have to shovel_________.
5. I throw the ball up and then it comes_________.

S's responses:________ _________ ________ ________ ________

5b

1. The snail is slow, the rabbit is_________.
2. At a birthday party we usually eat ice cream and_________.
3. Sandpaper is rough but glass is_________.
4. In the garden the workers pick ears of_________.
5. Over the fields, the girl rode the galloping_________.

S's responses:________ _________ ________ ________ ________

5c

1. To cut meat, we use a sharp_________.
2. In the daytime it is light, and at night it is_________.
3. Dogs have four_________.
4. At the grocery store we buy_________.
5. A man is big, a baby is_________.

S's responses:________ _________ ________ ________ __________

DIGIT SPAN (from WISC-R, Wechsler, 1974)

Discontinue: after failure on ***both trials*** of any item.

Directions:

Say, **"I am going to say some numbers. Listen carefully, and when I am through say them right after me".**

The digits should be given at the rate of one per second. *Administer both trials of each item, even if the child passes Trial 1.*

Each item is scored 2,1, or 0, as follows: 2 points if the child passes both trials, 1 point if the child passes only one trial, 0 points if the child fails both trials.

DIGITS	PASS-FAIL	SCORE 0,1,2
3-8-6		
6-1-2		
3-4-1-7		
6-1-5-8		
8-4-2-3-9		
5-2-1-8-6		
3-8-9-1-7-4		
7-9-6-4-8-3		
5-1-7-4-2-3-8		
9-8-5-2-1-6-3		
1-6-4-5-9-7-6-3		
2-9-7-6-3-1-5-4		
5-3-8-7-1-2-4-6-9		
4-2-6-9-1-7-8-3-5		

CODING CRITERIA FOR Birthday Task

OVERALL COMPETENCE RATINGS

Levels 1-4 Gesture, Repeat + Look, I don't understand, What do you mean?

Rating	Description
1	Child doesn't appear to notice/says nothing
2	appears to notice (e.g., brief pause in activity/sustained eye contact(>2 seconds), but says nothing/continues with what he/she was doing prior to E's response/**OR** says something irrelevant which doesn't resolve ambiguity (e.g., "I don't know")
3	repeats what was said with no elaboration
4	repeats with elaboration of mediocre quality
5	elaborates well/good description for Experimenter

Bizarre Levels 1 & 2

Rating	Description
1	appeared not to notice/ignores
2	notice with no talking/brief change of facial expression without break in activity
3	break in previous activity/more eye contact (>2 seconds) and/or exaggerated facial expression
4	did you say..? I thought you said.../or a response from child's own perspective "I can eat the cake myself" "I like grass" "sometimes"
5	child corrects E "I didn't say that""I didn't eat grass" or child takes E's perspective ("do you eat grass?")

Sad level

Rating	Description
1	appeared not to notice/ignores
2	change topic immediately/ "birthdays make me happy" with no acknowledgement E is sad
3	child notices, may look saddened too, but says nothing (acknowledgement with no comment e.g., eye contact maintained for 5 seconds)
4	Query after delay > 5 seconds
5	"Why?" "How come?"--immediate response < 5 seconds

CODING CRITERIA FOR Birthday Task -OVERALL COMPETENCE RATINGS (continued)

Normal levels 1-5

First normal statement/question following randomly chosen time segments on tape.

Rating	**Description**
1	child doesn't appear to notice/acknowledge statement or Q
2	child notices comment or Q but says nothing/or says something inappropriate (e.g., "I don't changes the topic without answering question
3	child answers Q's/acknowledges statement with appropriate head nodding or shaking or a gesture **(i.e., A NONVERBAL RESPONSE)**

There is a subtle difference between 4 & 5 and it depends upon the nature of the utterance made by the E. For example, if the Question posed by the E is closed the child gets 5 for a one word response, otherwise the child gets a 4.

4	child answers Q appropriately, or acknowledges statement with a nod + umm hmm (verbal response) but offers no additional information even if Q is open ended
5	child answers Q appropriately and **MAY** add information to it, or acknowledges statement with a nod/hmm hmm + eye contact

(depends on type of question)

CRITERIA FOR PRE/POST EVENT INDICES (Birthday Task)

i) Social Engagement: responding quickly to Q's, motivation towards conversation, degree of interest, eye contact with experimenter vs. eye movement (looking around)

Rating	Description
1	conversation not connected, child may try to change subject, low degree of interest in Q's, slow response to Q's, disinterest in E or in talking with E
2	low connectedness, fairly slow to respond, may be low eye contact low degree of interest in Experimenter, doing the task begrudgingly
3	some connectedness, fairly quick to respond (even head nodding), may be low eye contact low degree of interest in Experimenter but doing the task **OR** fairly good eye contact with E and nothing else.
4	some connectedness, fairly quick to respond, **OR** listening to experimenter + good eye contact (consistent but not staring); some interest in E without adding additional information (e.g., expanding on a point, describing a present etc.)
5	conversation is connected, quick response to Q's, **OR** listening intently +good eye contact , and offering additional information to E without being asked (some children will talk with hands to elaborate or "draw" on the table)

ii) Affect: -positive affect with task, enjoyment of the conversation

Rating	Description
1	lots of frowning, heavy sighs, discontent/boredom with task (e.g., eye rolling, tone of voice)
2	some frowning, or a continuous neutral expression, perhaps some heavy sighing, though not as much as in 1
3	occasional smirk or smile neither having fun nor having a "bad time"/Neutral in facial expression and tone of voice
4	may be some smiling, having some fun (i.e., not neutral), tone of voice is pleasant, **OR** one full face smile (does not have to be continuous for the entire epoch)
5	smiling (full face smile), pleasing tone of voice, having fun. There may be some laughing or one outburst of laughter

CRITERIA FOR PRE/POST EVENT INDICES (Birthday Task) continued

iii) Anxiety: behaviours such as hair touching, hand wringing, hair sucking, face rubbing, lip biting, lip pursing and other automanipulations or object manipulation, perhaps feet swinging if they can be seen on the tape.

N.B.* child may be holding hands--in itself this is NOT anxious behaviour, look for actual hand movements, finger movements, nail picking etc.**

Rating	**Description**
1	relaxed, comfortable, absence of anxious behaviours
2	1 fleeting (< 2 seconds) anxious behaviour or look/ or a sense that child is not comfortable (describe if not a behaviour outlined above)
3	1 or more anxious behaviour(s) > 2 seconds
4	some anxious behaviours, not continuous (e.g., child moves hands away from face if only for a second)
5	Continuous movement, usually repetitive motions, or 1 extreme anxious movement (describe)

OVERALL RATINGS FOR Lego Task

NORMAL INSTRUCTIONS

For this category of instructions, children get a rating of 0 or 1 depending upon whether the block was placed correctly RATING column of coding sheet.

1= the block in question was placed correctly on the building.

0= the block was placed incorrectly.

If the block was placed incorrectly, then describe what the child does and record it in the **CHILD BEHAVIOUR** column. Examples of what the child might do include::

(1) does not notice error

(2) seeks assistance/clarification of instruction

(3) self-corrects the error

IMPOSSIBLE INSTRUCTIONS

Rating	**Description of child behaviour**
1	Child doesn't appear to notice/places a block without question
2	Appears to notice (e.g., brief pause in activity/sustained eye contact (about 2 seconds), puzzled expression), but chooses a block anyway
3	Appears to notice a problem with the instruction hesitates before selecting a block ($\geq$ 3 seconds) may say hmmm for example, but does not seek information from Wendy. Sometimes the child may ask a rhetorical question /"This?" when the block has already been placed
4	Child asks E to repeat or confirm the instruction (e.g., What did you say, The horzingloffen? This one? Which one?--basically, asking to repeat
5	Here the child asks for clarification. For example, the child says "I couldn't understand you", "I don't know what that is", or "I've never heard of that before" or What's a horzingloffen?

OVERALL RATINGS FOR Lego Task (continued)

AMBIGUOUS INSTRUCTIONS

---at levels with prompts from confederates see lists for examples

*****N.B. the child should seek clarification from the E (Wendy)**

BUILDING #1

Rating	**Description of child behaviour**
1	Child doesn't appear to notice ambiguity selects a block + says nothing
2	Appears to notice (e.g., brief pause in activity/sustained eye contact (about 2 seconds), puzzled expression), but chooses a block anyway.
3	Appears to notice a problem with the instruction hesitates before selecting a block ($\geq$ 3 seconds) may say hmmm for example, but does **not** ask for information from E (Wendy); e.g., "I could use this one too"
4	Child asks E to repeat or confirm the instruction (e.g., Did you say the red one?). Here child recognizes a problem with the instruction but not exactly what it is
5	Child says Which one ? This one?/Holds up a block as if confirming it is the right one. There is obvious recognition that child knows what the nature of the ambiguity is. For example, "the big one?"

BUILDING #2-- "THAT'S A PROBLEM"

Rating	**Description of child behaviour**
1	Child doesn't appear to notice ambiguity selects a block + says nothing **OR** child says "it is?"
2	Appears to notice (e.g., brief pause in activity/sustained eye contact (about 2 seconds), puzzled expression), but chooses a block anyway . Child may say "What's a problem?"; "I know"; "I know, but it's this one"
3	Appears to notice a problem with the instruction hesitates before selecting a block ($\geq$ 3 seconds) may say hmmm for example, but does **not** ask for information from E (Wendy) **OR** child switches blocks (if one had already been placed)

#4 OR #5 are for those children who seek information from E (Wendy)

4	Child asks E to repeat or confirm the instruction (e.g., Did you say the red one?). Here child recognizes a problem with the instruction but not exactly what it is

OVERALL RATINGS FOR Lego Task (continued)

5 Child says Which one ? This one?/Holds up a block as if confirming it is the right one. There is obvious recognition that child knows what the nature of the ambiguity is. For example, "the big one?"

******Children who have asked Wendy about ambiguous instructions twice receive a 5 for their score for ambiguous directions for the subsequent buildings even if they stop asking Wendy which one. These kids know the nature of the problem and they have given up on getting any information from Wendy. If a child asks for clarification from Wendy only once, they do not get a 5 for subsequent buildings. They get scored according to the criteria set for each level.**

BUILDING #3--"THAT'S A PROBLEM. YOU HAVE MORE THAN 1 WHITE BLOCK"

Rating **Description of child behaviour**

1 Child doesn't appear to notice ambiguity selects a block + says nothing **OR** child says "it is?" **OR** child briefly hesitates but does not focus on the blocks at all

2 Appears to notice (e.g., brief pause in activity/sustained eye contact (about 2 seconds) with blocks, puzzled expression), but chooses a block anyway . Child may say "I know"; "I know, but it's this one"

3 Appears to notice a problem with the instruction hesitates before selecting a block ($\geq$ 3 seconds) may say hmmm for example, but does **not** ask for information from E **OR** says "ya" indicating they know there's a problem **OR** child switches blocks (if one had already been placed)

#4 OR #5 are for those children who seek information from E (Wendy)

4 Child asks E to repeat or confirm the instruction (e.g., Did you say the red one?).

5 Child says Which one ? This one?/Holds up a block as if confirming it is the right one. There is obvious recognition that child knows what the nature of the ambiguity is. For example, "the big one?"

OVERALL RATINGS FOR Lego Task (continued)
BUILDING #4--"THAT'S A PROBLEM YOU HAVE MORE THAN 1 WHITE BLOCK. WHAT COULD YOU DO ABOUT THAT?"

Here we are looking to see if the child can devise a plan. If the child can come up with more than 1 plan (i.e., realizes you could use either the large or small white block) they get a 4. Even if this realization is **after** the prompt from the C. The child who asks wendy which one it is gets a 5.

Rating	**Description of child behaviour**
1	Child doesn't appear to notice ambiguity selects a block + says nothing **OR** child says "I don't know" (shrugs shoulders)
2	Appears to notice (e.g., brief pause in activity/sustained eye contact (about 2 seconds), puzzled expression), but chooses a block anyway **OR** if child uses both the large and small block
3	Appears to notice a problem with the instruction hesitates before selecting a block ($\geq$ 3 seconds) may say hmmm for example, but does **not** ask for information from E (Wendy) **OR** child switches blocks (if one had already been placed)

#4 OR #5 are for those children who seek information from E (Wendy) or can come up with more than one plan

4	Child asks E to repeat or confirm the instruction (e.g., Did you say the red one?). Here child recognizes a problem with the instruction but not exactly what it is. Child says "I could use this one or I could use this one"
5	Child says Which one ? This one?/Holds up a block as if confirming it is the right one. There is obvious recognition that child knows what the nature of the ambiguity is. For example, "the big one?"

OVERALL RATINGS FOR Lego Task (continued)
BUILDING #5--"THAT'S A PROBLEM YOU HAVE MORE THAN ONE RED BLOCK. WHAT COULD YOU DO ABOUT THAT? I GUESS YOU COULD......"

Here 3 possible plans are given to the child. The best plan is to seek information from Wendy. If the child asks a question of Wendy the child receives a 5. If the child picks a block, he/she gets a 4 in this case because they have been told that is one of the things that they may do. Children receive a 1 if they continue to have no recognition of the nature of the ambiguity or its implication. For example, children who say things after the prompt like "Ya, but I have 2 of all the blocks", etc.

Rating **Description of child behaviour**

1 Child doesn't appear to notice ambiguity selects a block + says nothing **OR** child says "it is?" **OR** child says "I don't know"/ shrugs--does not notice

2 Appears to notice (e.g., brief pause in activity/sustained eye contact (about 2 seconds), puzzled expression), but chooses a block anyway . Child may say "What's a problem?"; "I know"; "I know, but it's this one"

3 Appears to notice a problem with the instruction hesitates before selecting a block ($\geq$ 3 seconds) may say hmmm for example, but does **not** ask for information from E (Wendy) **OR** child switches blocks (if one had already been placed)

#4 OR #5 are for those children who seek information from E (Wendy)

4 Child asks E to repeat or confirm the instruction (e.g., Did you say the red one?). Or just picks one of the blocks.

5 Child says Which one ? This one?/Holds up a block as if confirming it is the right one. There is obvious recognition that child knows what the nature of the ambiguity is. For example, "the big one?", even if **after** the prompt.

Lego Task DESCRIPTION OF PRE/POST BEHAVIOURS

i) AFFECT: -positive affect with task

Rating	Description
1	lots of frowning, heavy sighs, discontent/boredom with task (e.g., eye rolling, tone of voice) Child may assume continuous bored posture (e.g., head on hands + frown)
2	bored posture for majority of epoch (e.g., child sits back after placing blocks with neutral or negative expression, arms crossed), some frowning, **OR** a continuous neutral expression, perhaps some heavy sighing, though not as much as in 1
3	Neutral in facial expression and tone of voice--there may be an occasional smirk or smile but child is neither having fun nor having a "bad time" (**N.B.** puzzled looks are not necessarily negative)
4	may be some smiling, having some fun (i.e., not neutral), tone of voice is pleasant, **OR** one full face smile (does not have to be continuous for the entire epoch)
5	smiling (full face smile), pleasing tone of voice, having fun. There may be some laughing or one outburst of laughter

ii) ANXIETY: behaviours such as hair touching, hand wringing, hair sucking, face rubbing, lip biting, lip pursing and other automanipulations or object manipulation (e.g., taking the blocks apart and putting them together over and over again), perhaps feet swinging if they can be seen on the tape. Also, do not count the child who tries to reposition or firm up the block as an anxious behaviour--this indicates task engagement.

N.B.* child may be holding hands--in itself this is NOT anxious behaviour, look for actual hand movements, finger movements, nail picking etc. Anxious looks not coded per se. If the child just displays an "anxious look", then child receives a 2 if the look is anxious and there is another behaviour then the child may be rated as more anxious than not.**

Rating	Description
1	relaxed, comfortable, absence of anxious behaviours
2	1 fleeting (< 2 seconds) anxious behaviour or look/ or a sense that child is not comfortable (describe if not a behaviour outlined above)

Lego Task DESCRIPTION OF PRE/POST BEHAVIOURS (continued)

3	1 or more anxious behaviour(s) > 2 seconds (anxious about half the time and half not) **OR** child who appears anxious though not a fully repetitive motion (e.g., lips folded in for majority of epoch) this behaviour may be anxious or the child may be thinking--Therefore score as 3. Other near continuous behaviours that may or may not be anxious are also considered 3
4	some anxious behaviours, not continuous but majority of epoch ($\geq$ 5 seconds) For example, the child moves hands away from face if only for a second. Here the child is more anxious than not **OR** checking to see if the C will say something + anxious look
5	Continuous movement, usually repetitive motions, or 1 extreme anxious movement (describe)

iii) SOCIAL ENGAGEMENT:
Responding quickly to any social Q's, attempts to converse or motivation towards conversation, degree of interest in experimenter, eye contact with experimenter vs. eye movement (looking around). Statements about the task (not repetitions of commands) are considered social utterances; e.g., "simple", "this is fun", "that's the top!"

Rating	**Description**
1	no attempts to converse, low interest in E, reduced eye contact with E , low degree of interest in talking with E if a social Q is asked. Active avoidance of E
2	avoiding eye contact with E, turning head or body away (increases distance between E and child)from E, not as actively avoiding as in number 1
3	Neutral point--child is neither positively or negatively engaged socially with E. Not actively avoiding E or conversation with E.
4	At least 1 social statement, pleasing tone of voice + eye contact with E (even a "hmmm" + good eye contact or "whoops" + eye contact) **OR** asking questions of E in a "social" manner (pleasing tone + good eye contact) **OR** answering a social Q quickly with a nod + good eye contact + smile. For example, responding to a yes/no Q with many words

Lego Task DESCRIPTION OF PRE/POST BEHAVIOURS (continued)

5	High social engagement with E. Child may try to strike up a conversation with E and does so in a manner that conveys interest in E or talking with E. "Hey, I think that this looks like a building I made last week..." "Do you want to know what I'm doing later today?" etc.

TASK ENGAGEMENT:

Responding quickly to directions, or asking questions about placement (e.g., "here?") motivation to complete building, looking at blocks, hands on blocks as if ready to choose one. These children are "engaged with task"- they may re-centre the building .

Rating	**Description**
1	Disengagement with task. "Can we do something else?" "How many more?" "When can I do something else?" "I don't want to do this anymore" "I hate Lego"
2	Child places blocks incorrectly and does not care. The child may do this intentionally (playing games, as in making their "own" building) **OR** the child just is not motivated to do task, doing it begrudgingly or needs much prompting to continue.
3	Neutral point--child is neither positively or negatively engaged with task. **OR** child is doing task but assumes a bored posture **OR** looks out window a lot **OR** child follows instructions but "does his/her own thing" in between directions **OR** child is doing task alright but flops back in chair after each instruction (bored posture perhaps) **OR** distracts him/herself from the task by noticing something in the room, the tape on the blocks etc. Children who flop back in chair after block placement also receive a 3. Another example would be if a child refused to place the last block because it was already somewhere else
4	Following instructions (waiting for them), showing some interest in the building, often the child will focus on the blocks. Child may ask Wendy "is it one of these?" showing an interest in proper block selection. the child is also interested in proper block placement "does it go this way?". The child need not verbalize these questions to show task engagement, however. the child who places blocks quickly and looks over blocks before selecting without comment is also engaged with the task. In general, the child shows concern for proper block choice and/or placement.
5	Child is eager to make building and make it correctly. Very concerned with block choice +placement. Follows directions discussed in practice trials intently e.g., hammers blocks etc.